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ABSTRACT

Energy lessons, activities, and materials for vocational technology, science, English, and social studies classes are presented in this manual. Topic areas addressed in the sections include: (1) introduction to the current energy situation; (2) energy conservation; (3) preparation for energy careers; (4) energy for English classes, focusing on the writing about energy themes and experiences; (5) touring a power generating plant; (6) exploratory vocational lessons in energy; and (7) lessons with "Aunt Energinia." The latter lessons are taught in conjunction with "The Adventures of Aunt Energinia," classroom materials available from the Florida Power Corporation. Objectives, instructional strategies, and student materials (unless otherwise noted) are provided. All lessons presented are consistent with 10 fundamental principles about energy outlined in the introduction to the manual. (JN)

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# HARDEE COUNTY ENERGY EDUCATION LESSONS
# 1982-1983

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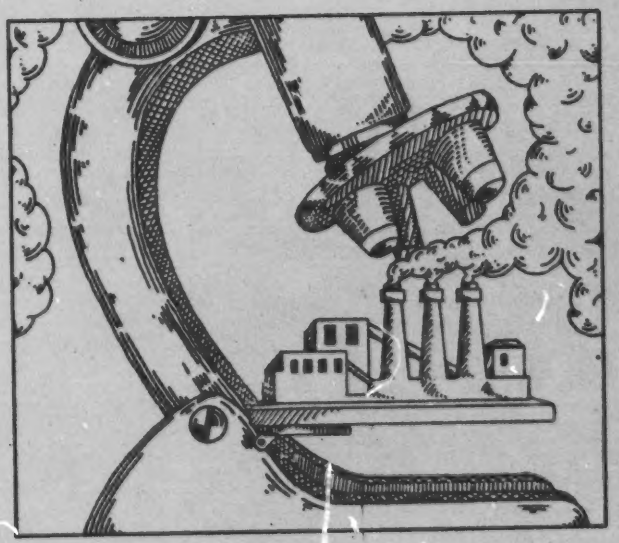
## TEACHER-PRODUCED LESSONS IN ENERGY FOR VOTEC, SCIENCE, ENGLISH, AND SOCIAL STUDIES CLASSES



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# HARDEE COUNTY ENERGY EDUCATION LESSONS

1982-1983

Lessons for students in English,
VoTec, Science, and Social Studies

Rodney F. Allen, Editor

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## INTRODUCTION

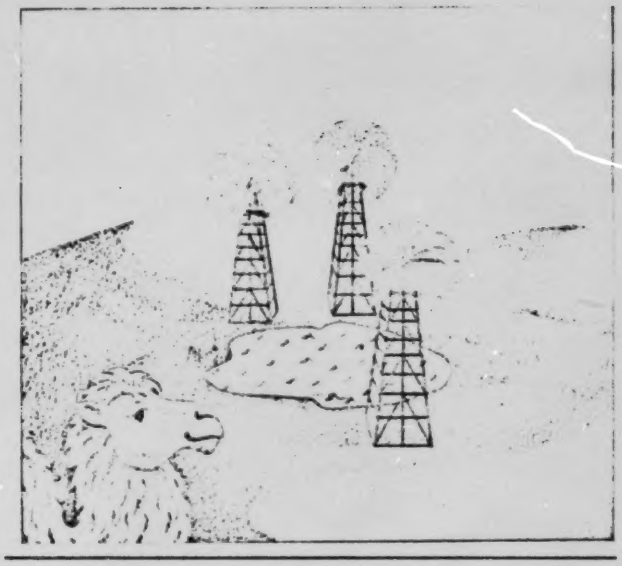
It was a lot easier to interest adults and students in learning about energy realities in the winter of 1973-74 and in those periods of subsequent brown-outs and black-outs than it is in 1983, with an international oil glut. The price of gasoline at the pump and natural gas in the pipeline are too much like to older days of seeming abundance. Prices are low. The will to conserve is lower. But, and this is the critical point, the energy situation in 1983 is a mirage. The Four Horsemen of ever decreasing supplies of non-renewable fossil fuels are riding toward us, ever closer, as we consume a finite supply. Prices will go up in our children's lifetimes, sharp transitions in the consumption of fossil fuels will be our legacy to our grandchildren. Of this, we can be certain.

There are ten fundamental principles about the world of energy, which we can forget to fail to learn, only at our peril:

1. The material Earth system is finite.
2. Our world system is essentially closed in a material sense (What we are going to have, is here!).
3. The Earth is an interlinked system such that actions on one part may affect all other parts.
4. The Earth is open to energy--solar energy and cosmic radiation.
5. There is no free good thing; there are no free lunches. All must be paid for now, or later in some way.
6. High quality resources are continually "consumed" and dispersed in our environment in a low-quality form.
7. Constructive processes tend to be slow; destructive ones may be very rapid.
8. There are finite limits to neutral systems as we have on Earth.
9. There is no finite limit on human creativity in finding ways to destroy natural systems....or to work within them positively.
10. Human survival with a reasonable quality of life will depend on knowing and using the above nine principles and developing a life style consistent with their meaning.

The energy lessons in this booklet are consistent with the ten principles and should help to prepare our youth for their futures together in a world of expensive energy sources and fragile natural systems.

Wayne H. Duncan, Director
Tri-County Teacher Education Center



PART ONE --

AN INTRODUCTION TO OUR ENERGY SITUATION

Useful films:

- ENERGY IN PRESPECTIVE (on loan from the FSU Center for Economic Education, Hecht House, FSU, Tallahassee, FL 32306)

THE KINGDOM OF MOCHA (on loan, from the FSU Center)

TITLE: Overview of Energy and U.S. society

CONCEPT: Awareness of U.S. energy chronology and the impact on the job market

OBJECTIVE: Students will become familiar with the history of energy use in the U.S. and energy resource development from approximately 1758 to present.

KNOWLEDGE BASE: An insight of how our past American energy supply and ultimate consumption has contributed to our present energy problems can help students in making future personal manpower plans and gain deeper knowledge of the ever-present energy challenge. Through past situations that loomed as serious problems, a student will be able to see the energy problem solved, and the student will better recognize their role in problem-solving the energy needs of the present and future.

Activity 1: Hand-out "Profiles of Change: From Wood to Nuclear, An American Energy Chronology." (Reference: Energy-A National Geographic Special Report, February, 1981, p. 5.).

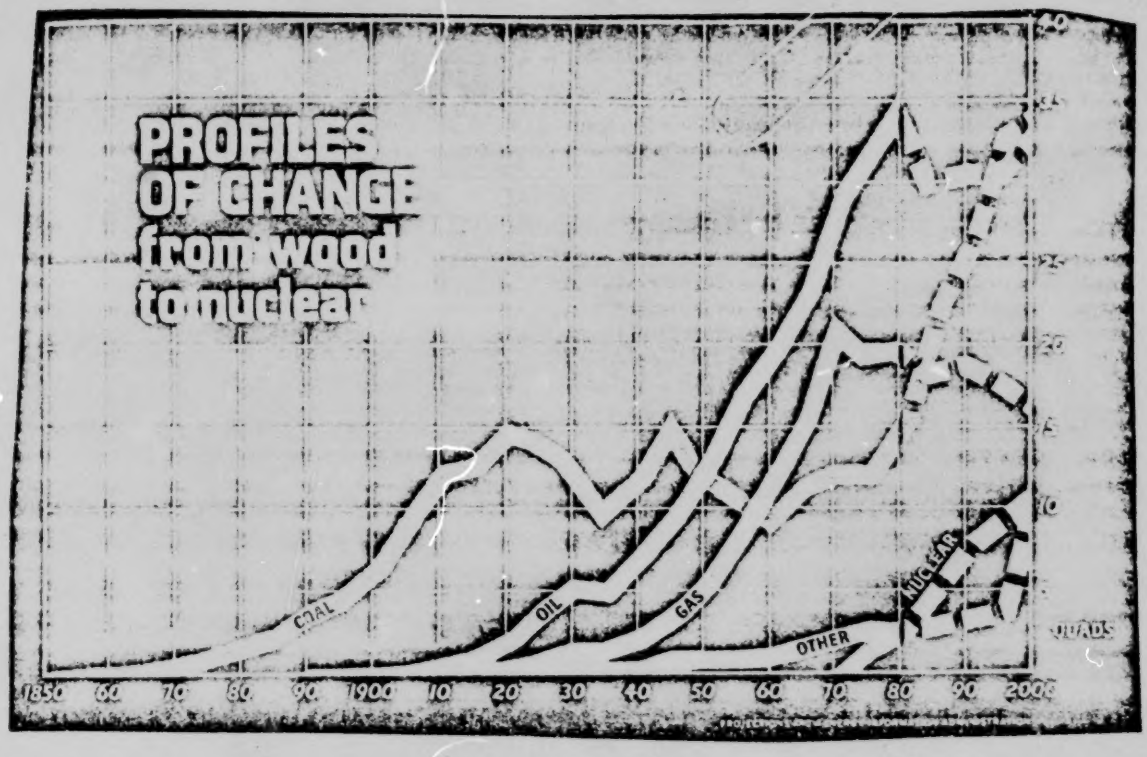
Use "Profiles of Change" as basis for introducing students to energy usage. Discuss the chronology of energy use and have students list careers they are familiar with that relate to each on the graph.

Activity 2: Hand-out the two graphs of "Energy Used in 1960 & 1979." (Reference: Energy: A National Geographic Special Report, February, 1981, pp. 18 and 19.)

Use "Energy Used" graphs to illustrate the increased demand for energy comparing quads and population for these two years and the time elapse. Ask students to do a time-projection from present to two decades into the future to extrapolate a "reasonable" population and quad demand. As Guidance Counselor or teacher, ask students to arrive at a conclusion as to the need for workers in both energy and environmental concerns as demand for energy increases. Based upon this discussion, ask students to add careers they believed will be in demand within a decade.

Activity 3: Hand-out "Muscle for Our Nation," by Graham Berry, Modern Maturity, Aug-Sept, 1981, pp. 57-61.

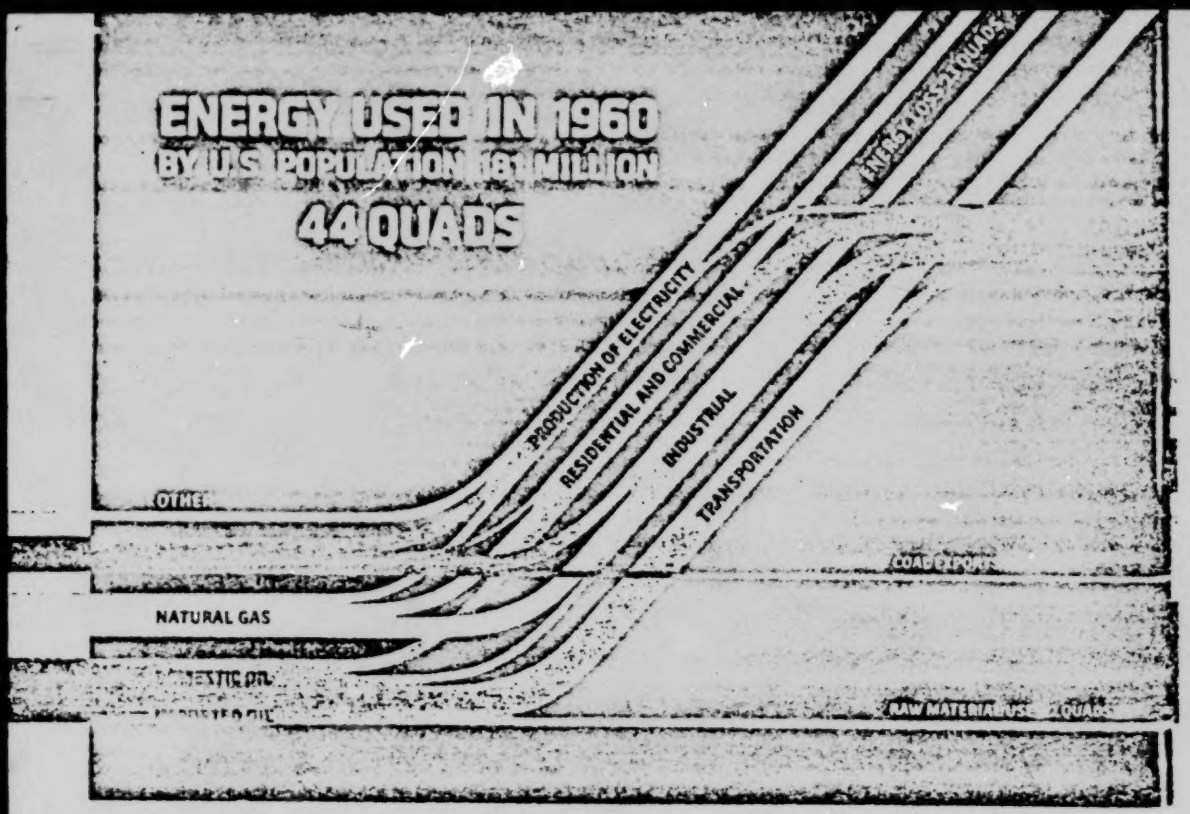
Using "Muscle," discuss the various energy modes (e.g. petroleum, natural gas, coal) listed in article. As a final listing of careers in this lesson, have students add to their list any additional careers that have become apparent.




AN AMERICAN
ENERGY
CHRONOLOGY

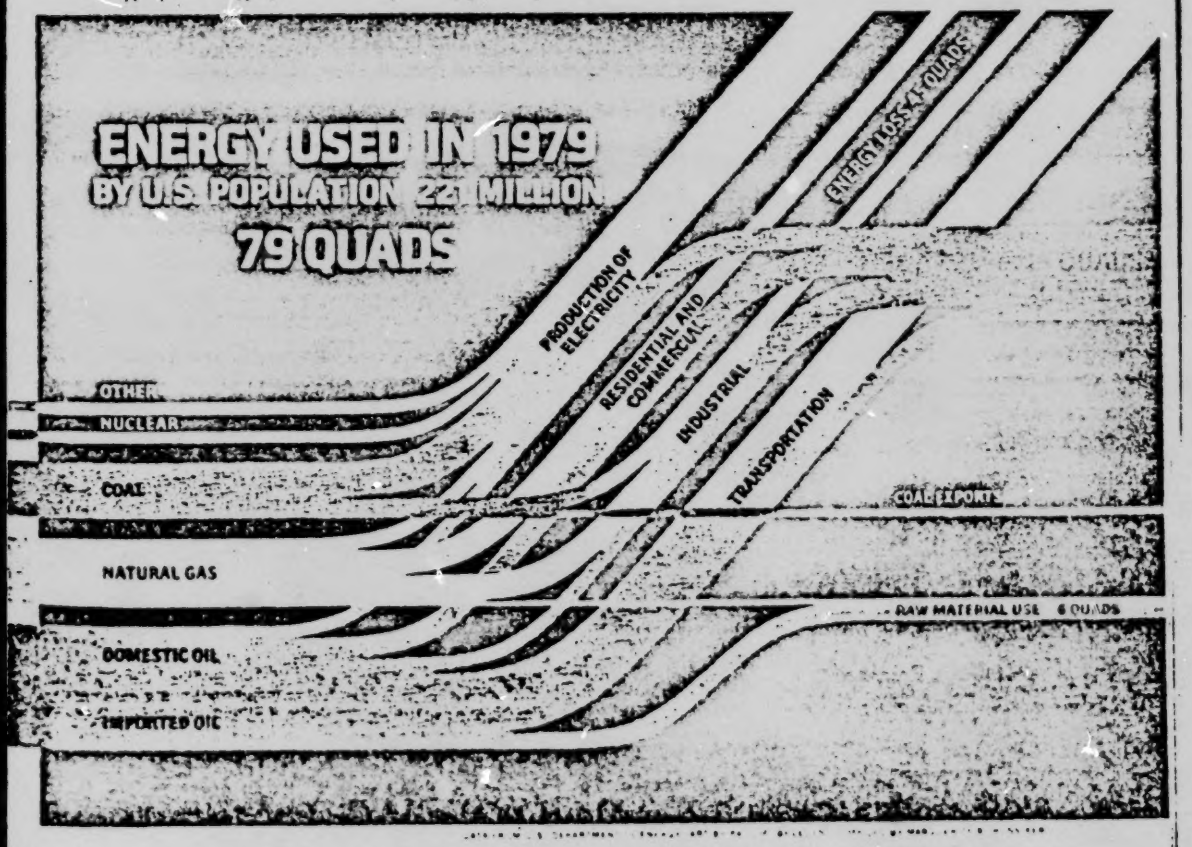
1758 - First recorded commercial shipment of American coal (32 tons from Virginia to New York).
1825 - First natural gas extracted in the United States lights streetlamps in Fredonia, NY. For decades natural gas is regarded as a flammable nuisance. It does not become a practical industrial fuel until the end of the 1920s.
1859 - Oil strike at Titusville, PA. starts U.S. oil industry, but petroleum does not become the primary U.S. energy source for nearly a century.
1879 - Electric streetlamps replace gaslights along Broadway in NY City.
1885 - Coal surpasses wood as the main U.S. energy source.
1913 - Ford assembly-line production brings car prices in reach of millions.
1947 - U.S. changes from a net exporter to an importer of oil.
1950 - Oil surpasses coal as main U.S. energy source.
1957 - First sale of nuclear-generated electricity.
1970 - U.S. oil production peaks.
1971 - Federal price controls placed on petroleum.
1973 - U.S. natural gas production peaks. Arab nations embargo oil exports to the U.S. for six months.
1974 - World crude oil prices quadruple between October 1973 and March 1974.
1975 - Congress passes Energy Policy and Conservation Act, which further regulates prices for domestic oil and provides for the Strategic Petroleum Reserve, automobile fuel-efficiency standards and a variety of conservation measures.
1977 - Department of Energy established, Solar Energy Research Institute formed.
1978 - Iranian revolution causes slowdown of Iranian oil production and halts exports for three months.
1979 - In Pennsylvania the Three Mile Island nuclear accident brings about a moratorium on nuclear-power-plant licensing.
World oil prices double as a result of panic buying induced by the Iranian cutoff. Domestic crude oil averages $14.27 a barrel. Imported crude oil averages $21.67 a barrel.
1980 - At the December meeting of the Organization of Petroleum Exporting Counties, Saudi Arabia sets $32 a barrel as its base price for crude-oil exports.
Iraqi-Iranian war begins; oil shipments from both countries are interrupted.

ENERGY: A National Geographic Special Report Feb. 1981. P.5.




P.718

*Energy sacrificed to convenience. 45 quads of power were "lost" in 1979—more than the total U. S. energy outlay in 1960. Heat lost in engine combustion*

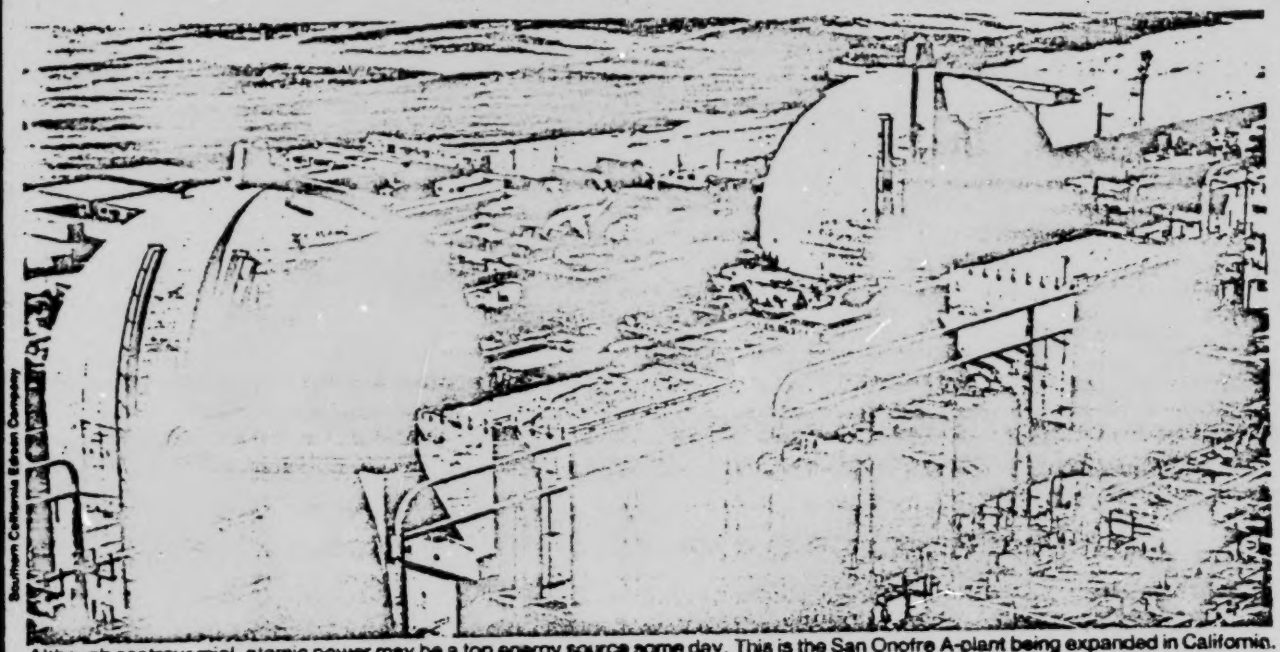



*and along transmission lines, and conversion losses in the production of steam to turn turbines, make transportation and electricity the big "losers."*

P.719



Energy : National Geographic Special Report Feb 1981




Although controversial, atomic power may be a top energy source some day. This is the San Onofre A-plant being expanded in California.

INTRODUCTION TO ENERGY

# MUSCLE FOR OUR NATION

By Graham Berry

The word "energy," when we were growing up, meant something you got from muscle. We thought of vitality as represented by manpower or horsepower—or horsepower's new-fangled mechanical substitutes.

Today, America finds energy to be a pervasive national issue. We are in a continuing "energy crisis," primarily because we consume a third of the world's output of energy and produce only about 14 percent of it.

Our industrialized society, with its huge demands for energy for illumination, heating, cooling, transportation and manufacturing, is built around the most convenient energy source—oil. It is accessible, easily transported, plentiful, and has been cheap. We rely on it for 40 percent of our energy needs.

Oil is also the raw material for our enormous petrochemical industry, which produces fertilizers, pesticides, plastics, detergents, drugs and synthetic fibers like rayon and nylon.

America was the kingpin of the oil industry until 1948—when we started importing more than we exported. After our peak production year of 1970, we became more dependent on foreign oil as our output declined and energy demands increased.

At present, 60 percent of the world's known oil reserves are concentrated among a few countries in the Middle East and North Africa that consume a tiny fraction of what they produce. Because their product is now a worldwide necessity, their cartel, the Organization of Petroleum Exporting Countries (OPEC) can set the price of oil on what the market will bear.

Prices have risen from $1.30 a (42-gallon) barrel in 1970 to $24 to $45 a barrel last year. Figuring an average 1980 price of $38 a barrel, that's a 30-fold cost increase in 10 years. This rise is reflected in all manufacturing and transportation processes in which petroleum is used, and is one of the keys to worldwide inflation.

Since the shock of the Arab oil embargo of 1973-1974, the United States has moved to free itself from overdependence on foreign oil. Conservation and development of other energy sources have been encouraged, and price controls on domestic oil have been lifted to stimulate oil exploration. The latter move has helped to push up gasoline and fuel-oil prices.

Domestic oil production increased, after a long decline, to 10 million barrels a day last year, but had dropped to 8.5 million by the end of May 1981 as surpluses developed. Oil imports have dropped to 5.3 million barrels a day—35 percent below the 1977 peak.

Conservation has reduced our energy demands below the projected 4 percent gain per year, causing David A. Stockman, director of the U.S. Office of Management and Budget, to exclaim: "One of the unsung miracles of our economy is the reduced use of oil."

The United States may cut importation of foreign oil in half by the end of the decade through conservation, more efficient use of oil and natural gas, extensive use of our bountiful coal supply, and development of such energy sources as nuclear, hydroelectric, solar, wind, methane gas from garbage, gasohol and tides. To promote development of these en-

continued

ergy sources, the Federal Government is relying on higher prices.

Early in the next century science may harness thermonuclear fusion—an inexhaustible energy source—and capture much more of the sun's energy. Then our energy worries could vanish.

### PETROLEUM PROSPECTS

As one of the world's three top oil producers, the United States contributes nearly 14 percent (over three billion barrels) of the world's annual (1979) output of some 22¾ billion barrels of oil. Russia produced 19 percent, and OPEC's Saudi Arabia almost 15 percent. The fourth-ranked producer (as of 1979) was OPEC's Iraq, with 5½ percent.

Worldwide crude oil production was down 4 percent to 59.67 million barrels a day last year as demand declined, the Oil and Gas Journal reports. The demand for OPEC oil dropped 12.9 percent to 26.8 million barrels a day.

By 1988, demands on OPEC are expected to be 42 to 45 million barrels daily. Although this production figure is possible, OPEC has indicated it wants to curtail production to extend the life of its oil and gas reserves.

A record 62,655 oil and gas wells were completed in the United States last year, according to the American Petroleum Institute, compared to 51,029 in 1979 and fewer than 30,000 in 1972. Most of the new drilling activity was in Texas, Oklahoma, California, Louisiana, Kansas, Ohio and Pennsylvania.

New regions producing oil and gas that promise more are the Rocky and Appalachian mountain chains, the Williston Basin in Montana and North Dakota, and the Anadarko Basin in the Oklahoma Panhandle.

The United States has substantial reserves: 28 billion barrels are known. Geologists estimate that 60 to 150 billion recoverable barrels of crude remain to be found.

Important untapped petroleum fields are said to lie off the shores of Alaska, California, Texas, Louisiana and our northeast coast. Most of the world's great oil pools lie under such continental shelves.

A major roadblock to opening territory for exploration has been government reluctance to permit drilling, a policy that is changing. The Federal Government, which controls a third

Department of Energy

In 25- to 35-mile-an-hour wind, windmill at Boone, N.C., could power 500 homes.

of the United States lands, including most offshore sites, recently took preliminary steps to open to drilling portions of the continental shelf off Northern and Central California over the objections of Governor Edmund G. Brown Jr. and environmentalists who objected on grounds this would endanger a beautiful stretch of seacoast.

Many older U.S. oil fields are still rich in petroleum. Conventional pumping extracts less than half the oil in an average petroleum reservoir. As prices rise, therefore, surface and underground mining for oil become more attractive.

The eventual drying up of oil fields does not mean the end of gasoline fuel. It can be manufactured from water and the atmosphere. Electricity breaks down water into hydrogen and oxygen. By combining the hydrogen with carbon dioxide from the air, gasoline is formed.

### NATURAL GAS

Natural gas, our second most important fuel, generates some 35 percent of our energy. The United States, which produces more of the gas than any other nation, in 1979 produced nearly 20 trillion cubic feet of it. That's the energy equivalent of about 10 million barrels of oil a day.

Russia is second with 12¼ trillion cubic feet and the Netherlands third with 3⅓ trillion. Texas and Louisiana each outproduces Russia.

Gas heats about half the homes in our country, is one of the major fuels for generating electricity, and is invaluable as raw material for the petrochemical industry.

It is the cleanest and least polluting of major fuels. The country is laced with over 980,000 miles of gas pipelines, not counting individual service lines, for transporting it. Price controls on this fuel are scheduled to end in 1985.

While only 12 percent of the world's oil reserves lie in North America and Europe, our continent has an estimated 30 percent of the world's natural gas reserves. Our known reserves in 1979 were 200 trillion cubic feet of the gas, and the probable reserves were 428 trillion cubic feet.

Last year, for the first time, more gas was discovered in this country than was used. Large reserves have been discovered in the sea beds along the coasts of Texas and Louisiana, in the Greater Anadarko Basin, and in the Overthrust Belt along the Rocky Mountains from Colorado into Wyoming. The U.S. Geological Survey estimates that 95 trillion cubic feet of gas may lie in Alaskan fields.

Natural gas can be imported from overseas by being cooled to minus 260 degrees Fahrenheit so that it becomes a liquid. As a liquid, it occupies only one six-hundredth the space it occupies as a gas.

### COAL

About 20 percent of America's energy is produced by coal, and this figure is expected to rise. We have the largest supply—30 percent—of the world's coal.

But because coal is dirty and awkward to distribute and use, its popularity has declined over recent years.

Now, however, enormous and readily available supplies make it attractive. We are using more coal, and in the first nine months of 1980 we exported 54 million tons of it. The National Coal Association estimates our recoverable reserves total nearly 220 billion tons, the energy equivalent of 1,100 billion barrels of oil. Recoverable coal in the U.S. is estimated at 1.0 to 1.8 trillion tons.

Coal has two major markets: in steel manufacturing and as boiler fuel; 90 percent of the latter generates electricity. The Library of Congress states that coal now fuels 47 percent

of our electrical generation. About 45 percent of the new generation capacity to be added through 1986 will be coal-fired.

There are obstacles, however, in increasing coal production, including regulations covering land use, safety, health and air pollution. Complying with them is driving up coal costs.

Transporting coal from mines to consumers also poses problems. Railroads claim they can do it. Pipeline transportation of coal mixed with water as a slurry is another option.

Principal coal fields lie in the Rocky Mountain states, Illinois, Indiana, the Appalachian Mountain states and Alaska.

It's significant that the U.S. and the rest of the world depend on oil, gas, and coal for 95 percent of their energy. These are the three fossil fuels, so-named because they evolved from the remains of ancient plants and animals.

### NUCLEAR

A few years ago nuclear power was thought to be the best way to generate electricity. Uranium-235 is very efficient; one ounce of it produces the energy equivalent of 388 barrels of oil. However, a growing public apprehension over the safety of nuclear power plants has dampened the acceptance of this energy source. The Three Mile Island accident near Harrisburg, Pa., in 1979 intensified this feeling.

Now the Federal Government requires stricter and costlier safety measures for the 67 operating nuclear reactors. These measures raised the possibility that the more than 90 nuclear power plants under construction will never be completed.

Other factors that have slowed the nuclear reactor industry have been opposition by environmentalists, poor planning on how to dispose of spent radioactive fuel, and the Carter Administration's lack of enthusiasm for nuclear energy.

The Government's attitude is changing, as is evidenced by the Nuclear Regulatory Commission's new attempts to speed the opening of nuclear power plants.

Encouragement also is now being given to accelerating development of the breeder reactor, so-called because it breeds its own fuel by enriching uranium. It generates 70 times the amount of energy per pound of uranium as ordinary reactors. Breeders use the wastes of other reactors to generate their own fuel, and may make it possible to multiply by 50 times the usability of uranium ores.

The breeder's safety and reliability have not been proved; but if it were abandoned, energy experts believe, nuclear power would be short-lived as an energy source in this country.

The public is concerned about the breeder reactor producing highly toxic plutonium, the substance from which atom bombs are made. It is feared that some nations might divert plutonium to make atom bombs, or that terrorists might steal enough to make one.

Meantime, Britain, France and several other nations are relying more and more on nuclear power.

### HYDROELECTRIC POWER

Hydroelectric power, which supplied a third of our nation's electricity 60 years ago, now produces only about 4 percent of it. In 1978, hydroelectric plants supplied us with the power equivalent of 1.5 million barrels of oil a day.

Generating electricity by water-powered turbines has its advantages. The energy source is renewable. There is no air pollution. The life of a dam powerhouse is two to three times that of a fossil fuel plant. The equipment is comparatively simple and has a lower operating cost.

Before the 1973-1974 Arab oil embargo, American hydroelectric plants were slowly being retired. There is still opposition from environmentalists and outdoor recreation people to developing new sites for dams on the grounds that they would destroy natural beauty and disturb wildlife.

The U.S. Army Corps of Engineers estimates that the present hydroelectric capacity could be nearly doubled by modernizing generators at existing dams, and through the use of bulb turbines, which fit inside an aqueduct or pipe and are completely submerged in moving water. They don't require a dam.

Most of the growth in hydroelectric power probably will be in developing countries, which have an estimated 44 percent of the world's potential for it.

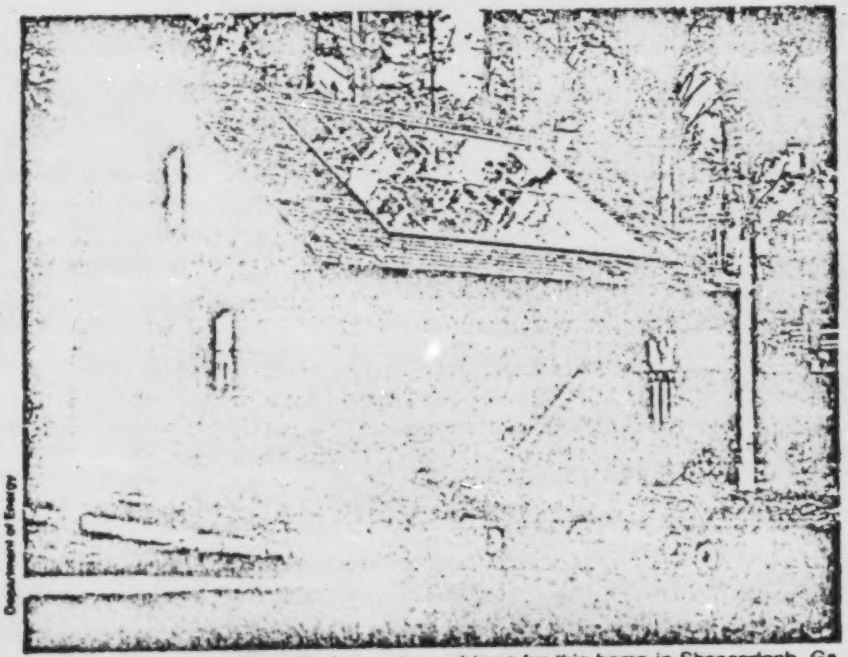
### OTHER ENERGY SOURCES

Development of alternative fuels is seen as a short-term answer to the oil dilemma. They include converting coal to liquids and gas, and extracting oil from rocky shale and from gooey sand deposits. Former President Carter wanted the Government to subsidize development of these sources, while President Reagan wants private industry to do it.

Coal conversion, in the research stage, will be thoroughly explored be-

continued





Department of Energy

Roof sunlight collectors provide hot water and heat for this home in Shenandoah, Ga.

cause coal is the only fossil fuel whose supply is apt to remain plentiful well into the next century. A plant is proposed for Henderson County, Ky., to convert 28,000 tons of coal a day to 65,000 barrels of oil equivalent. A coal gasification plant is being built near Daggett, Calif.

Oil already is being produced in the U.S. and Canada from tar sands and shale. There is more oil from these sources in the U.S., Canada, Colombia and Venezuela than in the Middle East oil fields. However, there are cost and environmental problems. Other sources are:

**Steam** from the earth's interior is turning electric turbines in Mexico, Iceland, New Zealand and California. Additional use of this geothermal energy is being sought in Southern California.

**Wind**, a nonpolluting, renewable energy source, is nearer being economically feasible now than any other alternate fuel, engineers say. Windmills are being installed at breezy sites. A "windmill farm" of 20 sets of propellers in New Hampshire is generating enough electricity to power 5,000 homes. A large windmill in Oregon, with a 17-mile-an-hour wind, produces enough electricity for a large office building.

**Ocean tides** produce great amounts of energy. France has a tidal power plant in Britanny with a 240-megawatt capacity, the rushing tidewaters turning electric turbines. Russia also has one. These power plants are most effective where tidal effects are amplified by a funnellike narrowing of the coastline, such as in Canada's Bay of Fundy; if all its energy could be captured it would produce as much electric power as Canada consumes.

**Biomass**—wood, corn, sugar cane, agricultural wastes, garbage—can produce ethyl alcohol, the only popular nonpetroleum fuel. Although alcohol doesn't contain as much energy, gallon for gallon, as gasoline, the alcohol in "gasohol" (10 percent alcohol, 90 percent gasoline) is clean and renewable. And half an acre produces the alcohol component of the gasohol to run a car for a year. In Brazil, 15 percent of the autos use only alcohol as fuel.

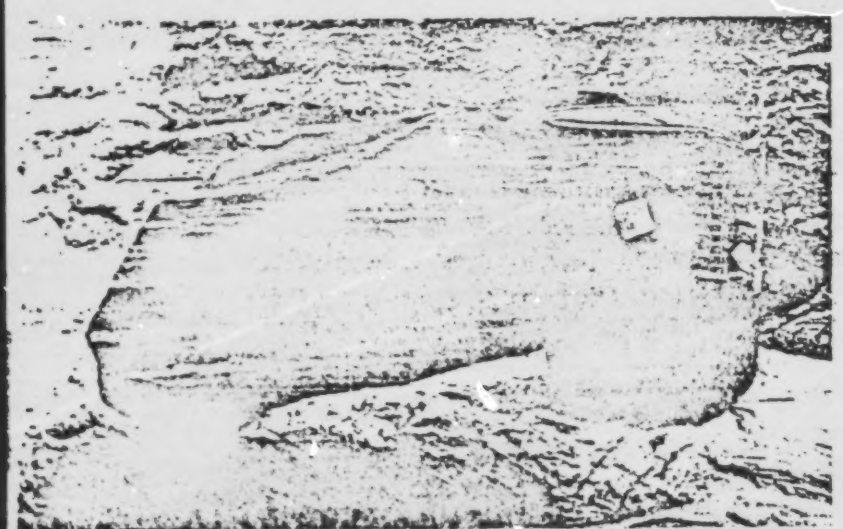
**Wood** was our first energy source. It still supplies a large fraction of developing countries' energy needs.

**Methane gas**, a fine fuel like natural gas, can be made from sewage and kelp, the world's fastest-growing plant. The machinery at Los Angeles' huge Hyperion sewage plant is powered by methane from the sewage.

**Hydrogen** will become a fuel of the future. There is an almost inexhaustible supply in water and it can be extricated by electrolysis, which, of course, takes energy. Hydrogen already fuels buses in Provo, Utah.

**Fuel cells**, batterylike devices in which gas or liquid fuels combine chemically to generate electricity, produced the electricity for the Apollo spacecraft that went to the moon. Researchers are working on improving the efficiency of these cells, which produce twice the electricity for a given amount of fuel.

**Batteries** are being developed to extend the range of electric cars to 300 miles. Ford is putting an electric car on the market and General Motors is developing one.



Extracting oil from shale (above) and sand are becoming more attractive alternatives.

### THE SUN

Science is looking to our thermonuclear furnace, the sun, as a long-range energy source. It provides the energy for virtually all living things, its light being converted by plants into chemical energy (sugars) that sustains the plants and the animals that eat the plants.

Sunlight is being used to heat water in homes. Solar water heaters are required on new all-electric homes in parts of Southern California. Houses are being designed to take advantage of sunlight, with maximum window space on the south sides and a minimum on northern exposures.

Silicon solar cells generating electricity directly from sunlight provide electric power for spacecraft. Researchers are attempting to manufacture solar cells cheaply enough so they can help generate electricity for homes. Solar furnaces have been used for a long time, focusing sunlight to melt metals and perform other high-temperature tasks.

Chemists are developing a way to use sunlight to release hydrogen gas fuel from water. A rhodium compound causes hydrogen to be released when placed in water and acted on by sunlight.

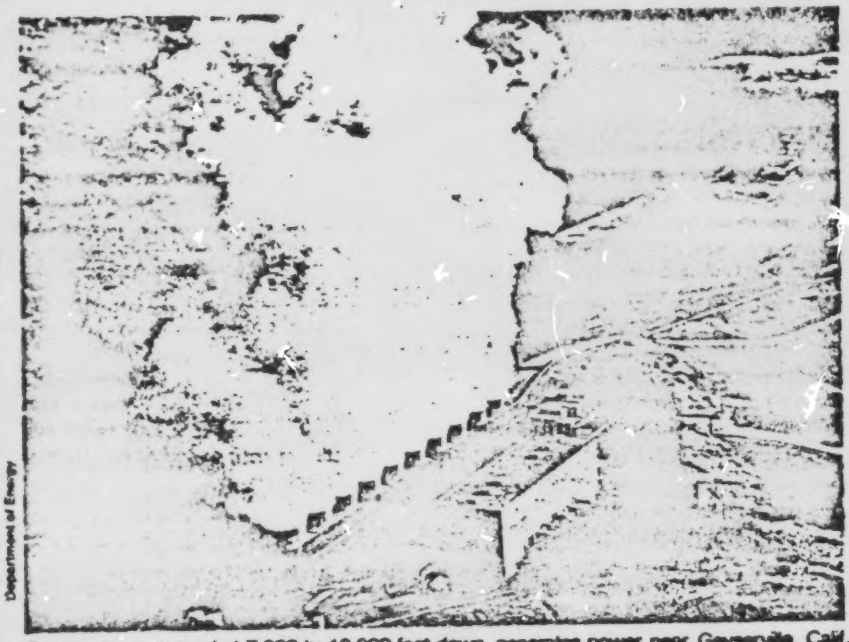
In the next century, large-scale sunlight collectors may be built above the earth's atmosphere. Engineers estimate that a four-mile-square reflector could produce from sunlight the energy equivalent of a large power station. Its solar energy would be transmitted to earth by microwave.

A dish-shaped antenna at Goldstone, Calif., transmits microwaves through the atmosphere to another antenna over a mile away where the received energy lights a bank of electric bulbs.

### FUSION

The most promising source of inexhaustible energy lies in creating on earth miniature versions of the sun's thermonuclear furnace. Scientists in several countries are slowly approaching this goal—fusion power.

Fusion consists of slamming the nuclei of lightweight atoms such as



Department of Energy

Geyser steam, tapped at 7,000 to 10,000 feet down, generates power near Geyserville, Calif.

hydrygen together so rapidly that they fuse, forming heavier atomic nuclei. This process releases 10 times the energy of fission, the reaction in conventional nuclear reactors that splits heavy uranium atoms apart.

Enormous heat—something like the 24 million degrees Fahrenheit in the sun's nucleus—and great pressure are required to induce fusion. It's been accomplished in the hydrogen bomb. But physicists want controlled, continuous fusion to produce heat for generating electricity.

The preferred fusion fuel is hydrogen, the most plentiful element in the universe. Hydrogen's heavier isotopes, deuterium and tritium, fuse at lower temperatures than hydrogen—forming helium nuclei—so they are being used in the difficult task of trying to achieve controlled fusion.

Fusion's waste products are nontoxic helium, plus neutrons and tritium that can be used as fuel as fast as they are produced.

## CONSERVATION

"Conservation may be the cheapest, safest, most productive energy alternative readily available in large amounts," states Harvard University's energy survey.

Some energy experts say that conservation by itself could halve energy imports by 1990 and eliminate them by the year 2000. In the past, we have been woefully wasteful of energy—some say up to 50 percent of it. Up to 25 percent of the heat in homes can be wasted from lack of insulation. Much of the heat in gas-heated homes goes up the vent, and pilot lights can consume 10 percent of the gas. Untuned autos and overilluminated buildings are other energy wasters.

Fortunately, Americans are becoming conservation conscious as gasoline and gas prices continue to rise, and as we become aware that oil is diminishing. We are driving slower and in smaller cars, using public transportation more, and are more frugal with electricity. Industry also is conserving energy—and saving money doing it.

## HISTORY

Humanity's use of energy has evolved from less to more efficient sources: wood, water power, coal, oil and gas, fission, and (not yet) fusion.

Early man first relied on his muscles—energized by food—then developed tools. Domestication of animals tripled the energy available to him. Inventions of the wheel and harness gave him fuller use of animal power.

The first source of mechanical energy was the water wheel, beginning about the first century B.C. In the 12th century A.D. the analogy between flowing water and flowing air was recognized and windmills were born.

Invention of the steam engine in the late 1700s touched off the Industrial Revolution; steam-powered machines took over many chores. The internal combustion engine, born in the late 1800s, revolutionized transportation. Electricity came along in that period and revolutionized our lifestyles.

The most used fuels up into the early 1800s were water, wind and wood. Coal came into use in the 1830s, and by 1900 was the major fuel. Now 75 percent of this country's energy comes from oil and gas.

## LEARNING MORE

There is a deluge of information about energy. Television, radio, newspapers and magazines are full of it.

Your public library's "Reader's Guide" lists current and recent periodical articles under the topic of "energy." Scientific American and Fortune frequently publish articles on phases of the subject.

Fine recent studies have been made by the National Research Council, the Ford Foundation, Harvard Business School and the Massachusetts Institute of Technology. They have been published in book form:

*Energy in Transition 1985-2010* by the National Research Council (W. H. Freeman and Co.)

*Ford Foundation Energy Project* series (several volumes) (Ballinger Publishing Co.)

*Energy Future* (Harvard study) edited by Robert Stobaugh and Daniel Yergin (Random House)

*Energy: Global Prospects 1985-2000* (MIT) project director Carroll L. Wilson (McGraw-Hill Book Co.)

Other excellent books:

*Energy Resources of the World* by the U.S. Department of State (Gordon Press Publishers)

*Prospects for Energy in America* edited by Eric F. Oatman (The H. W. Wilson Co.). □

Want to learn more about energy? Your Association offers a free booklet for individual or group use that contains a reprint of the minicourse plus a reading list and supplemental material. For group use, specify number (20 maximum). A discussion leader's guide is also available. Write to: Institute of Lifetime Learning, 1909 K Street N.W., Washington, D.C. 20049. Allow six weeks for delivery.

TITLE: Overview of Energy and U.S. society

CONCEPT: Awareness of world energy resources and consumption to generate cognition as to career growth in world economics.

OBJECTIVE: To help students analyze graphs and charts to identify world geographic areas and energy needs/trends.

To help students understand the different ways in which energy problems effects industrial and developing nations.

KNOWLEDGE BASE: An overview of "World Energy Resources" and the relationship to developed market economics, centrally planned economics, and developing oil net import/export countries will aid the student in gaining insight into the vast arena of global job markets. Analyze the 1970 to 1978 consumption of energy and electricity will add impact to a global prospect in future job markets.

Indexing of economics as to developed and centrally planned can aid in emphasizing the characteristics of a Free Enterprise System vs. Socialistic/ Communistic System and the freedom of choice factor is the U.S. economic system.

In breaking apart the four major users of energy (Residential, Commercial, Industrial, and Transportation) the student may be able to clarify his/ her thinking about careers within these four sectors. Need for energy as emphasized in Lesson 1A is on the increase and this strategy of examining the working markets of the "Consumption of Energy" should bring to light the realm of diversity in energy/environment job markets.

Activity 1: Hand-out "World Energy Resources" Energy Source Book #1, Edison Electric Institute, p. 102; and "World Consumption of Energy and Electricity" p. 101. Also hand-out p. 102 "Index of Countries." Discuss with students the world energy resources and how to read a circle graph. Follow through with a study of the world consumption of both energy and electricity circle graphs for the years

1970 and 1978. Assist the students in understanding a time elaspe circle graph and help their cognition in developing time projections and use of graphs.

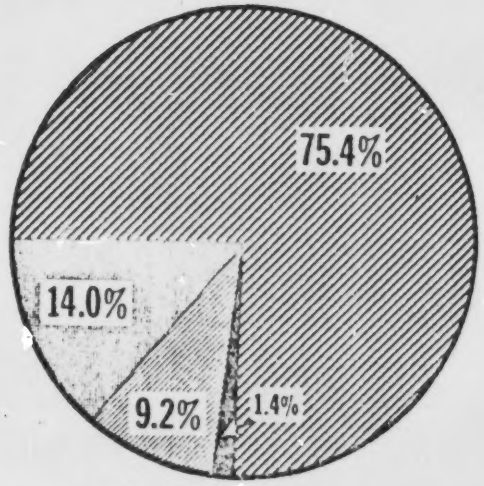
Activity 2: Using the Index of Countries have students locate these countries on a world globe or world map. Expand the thought that as the world countries become more dependent upon each other that real and artificial barriers tend to fade. Therefore, future generations will be concerned more with international job markets and mobility globally will become commonplace.

Activity 3: Using the "Consumption of Energy" hand-out, have the students compare several states to determine usage of energy by sector. Suggestion to use the States of Florida, Washington, New York, and California. Ask students to explain the reasons for the differences in consumption by both state and sector.

# WORLD ENERGY RESOURCES

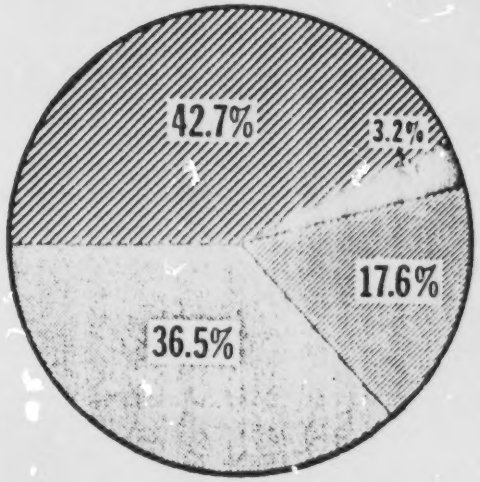
## Oil Proven Reserves

640.6 Billion Barrels of Oil Equivalent 1-1-80



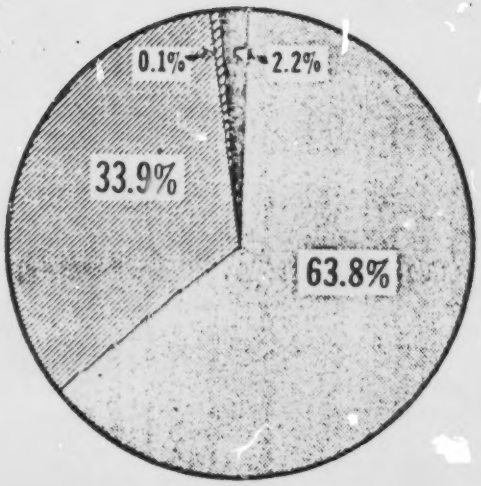

## Gas Proven Reserves

460.0 Billion Barrels of Oil Equivalent 1-1-80



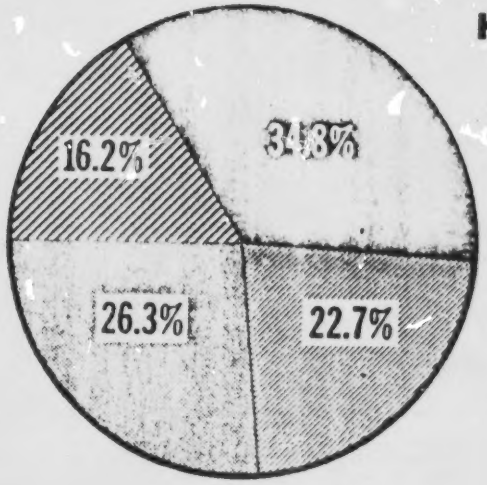

## Coal Resources

10,125.3 Billion Tons of Coal Equivalent as of 1977




## Hydro Resources

2,342.6 Thousand Megawatts as of 1974




Developed Market Economies

Centrally Planned Economies

Developing Net Oil Exporters

Developing Net Oil Importers

See Index of Countries, page 102.

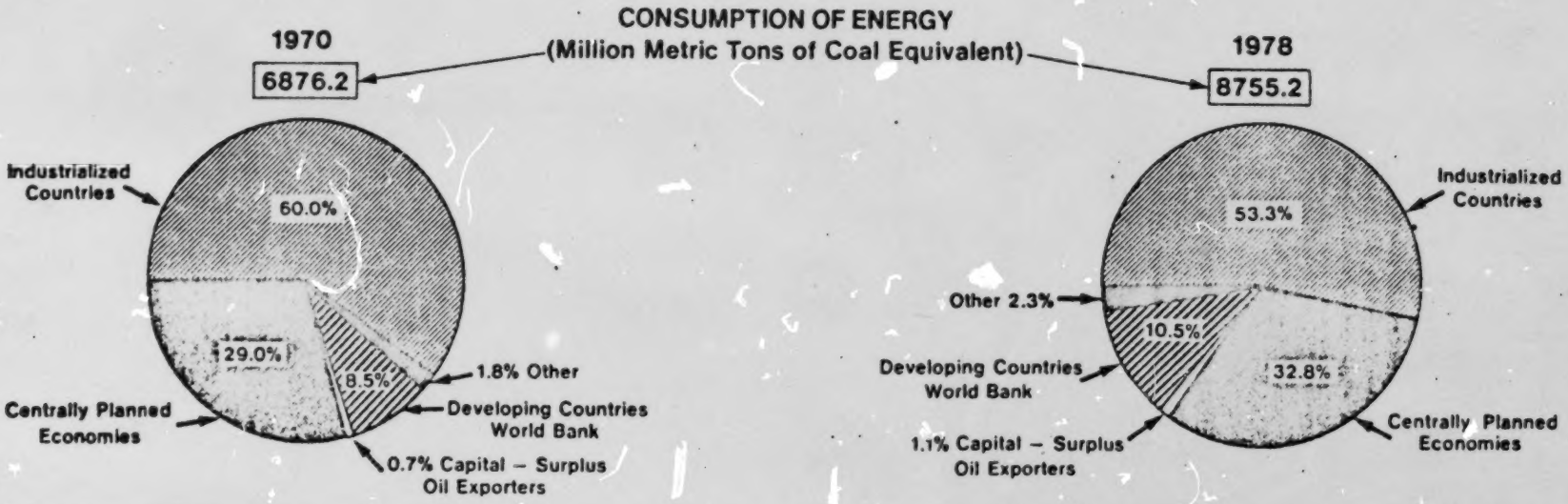
Source: World Bank. EBASCO

Energy Source Book #1

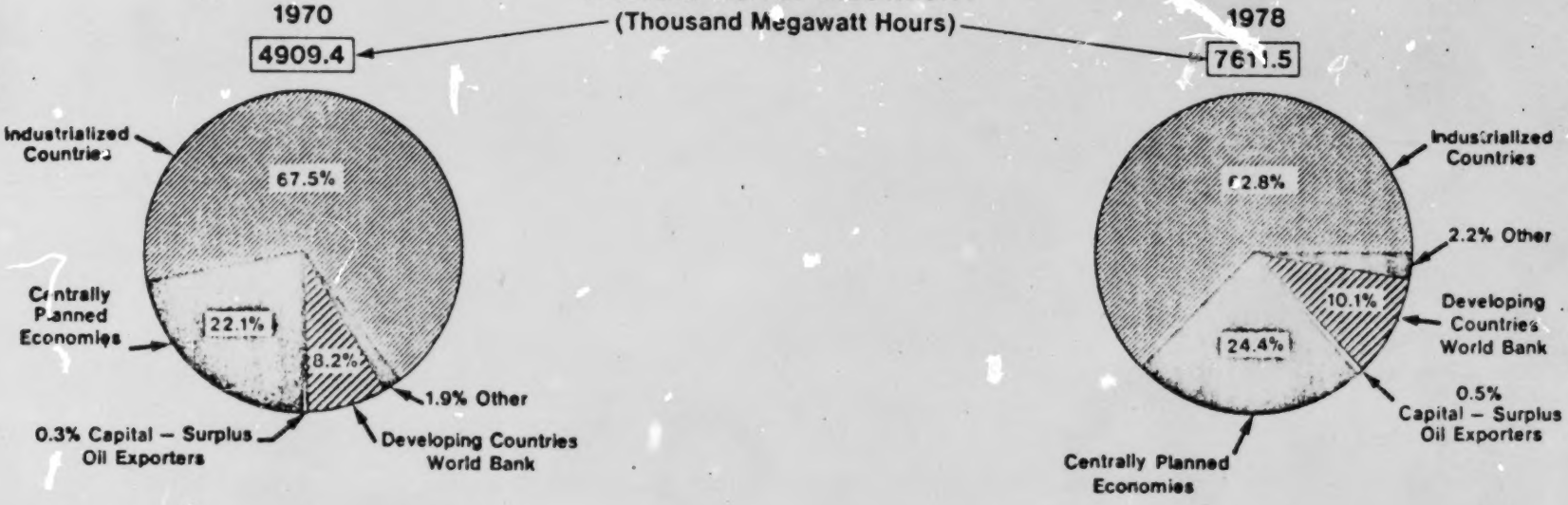
Edison Electric Institute
1111 19th ST. N.W
Washington, DC 20036

# WORLD CONSUMPTION OF ENERGY AND ELECTRICITY

## CONSUMPTION OF ENERGY
(Million Metric Tons of Coal Equivalent)




## CONSUMPTION OF ELECTRICITY
(Thousand Megawatt Hours)




Source: United Nations, Statistical Yearbook. EBASCO

# INDEX OF COUNTRIES


**DEVELOPED MARKET ECONOMIES**

AUSTRALIA
AUSTRIA
BELGUIM
CANADA
DENMARK
FRANCE
GERMANY, WEST
GREECE
ISRAEL
ITALY
JAPAN
NETHERLANDS
NEW ZEALAND
NORWAY
SPAIN
SOUTH AFRICA
UNITED KINGDOM
UNITED STATES

**CENTRALLY PLANNED ECONOMIES**

BULGARIA
CHINA
CZECHOSLOVAKIA
GERMANY, EAST
HUNGARY
KOREA, NORTH
POLAND
USSR

**DEVELOPING COUNTRIES NET OIL EXPORTERS**

ALGERIA
ANGOLA
BAHRAIN
BOLIVIA
BRUNEI
BURMA
CONGO
ECUADOR
EGYPT
GABON
INDONESIA
IRAN
IRAQ
KUWAIT
LIBYA
MALAYSIA
MEXICO
NIGERIA
OMAN
PERU
QATAR
SAUDI ARABIA
SYRIA
TRINIDAD & TOBAGO
TUNISIA
UNITED ARAB EMIRATES
VENEZUELA
ZAIRE

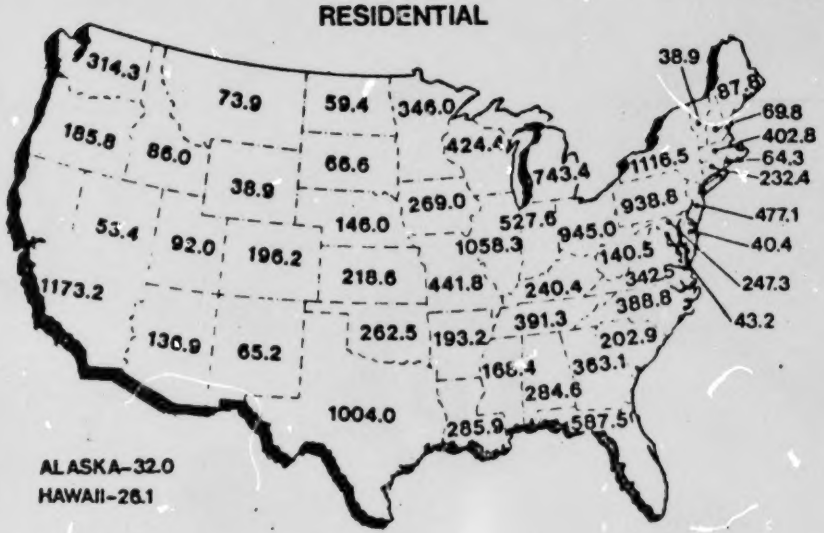
**DEVELOPING COUNTRIES NET OIL IMPORTERS**

AFGHANISTAN
ARGENTINA
BANGLADESH
BARBADOS
BENIN
BOTSWANA
BRAZIL
BURUNDI
CAMBODIA
CAMEROON
CENTRAL AFRICAN REP
CHAD
CHILE
COLOMBIA
COSTA RICA
DOMINICIAN REPUBLIC
EL SALVADOR
EQUATORIAL GUINEA
ETHIOPIA
FIJI
GHANA
GUATEMALA
GUINEA
GUINEA BISSAU
GUYANA
HAITI
HONDURAS
INDIA
IVORY COAST
JAMAICA
KENYA
KOREA, SOUTH
LAOS
LEBANON
LESOTHO
LIBERIA
MADAGASCAR
MALAWI
MALI
MAURITANIA
MAURITIUS
MOROCCO
MOZAMBIQUE
NEPAL
NEW CALENDONIA
NICARAGUA
NIGER
PAKISTAN
PANAMA
PAPUA NEW GUINEA
PARAGUAY
PHILIPPINES
PORTUGAL
REUNION
ROMANIA
RWANDA
SAO TOME & PRINCIPE
SENEGAL
SEYCHELLES
SIERRA LEONE
SOMALIA
SRI LANKA
SUDAN
SURINAME
SWAZILAND
SYRIA
TANZANIA
THAILAND
TOGO
TURKEY
UGANDA
UPPER VOLTA
URUGUAY
VIET NAM
WESTERN SAMOA
YUGOSLAVIA
ZAMBIA
ZIMBABWE

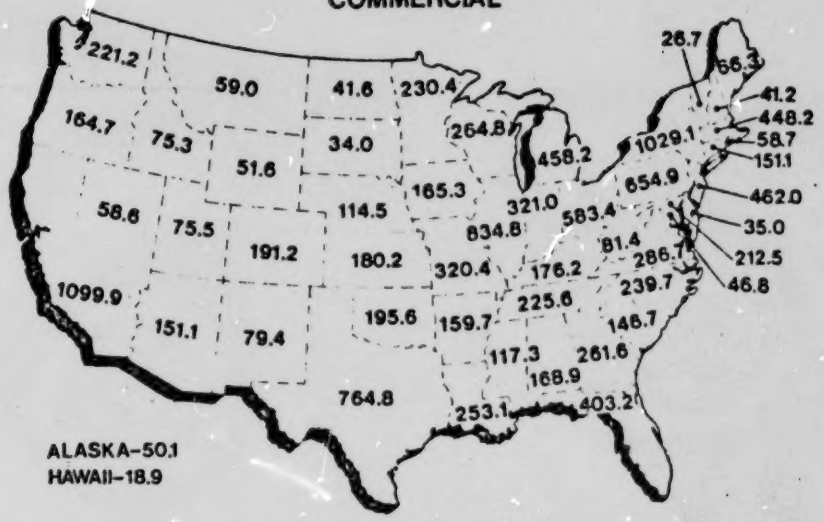
# CONSUMPTION OF ENERGY
## BY END-USE SECTOR-1978

(Trillion Btu)

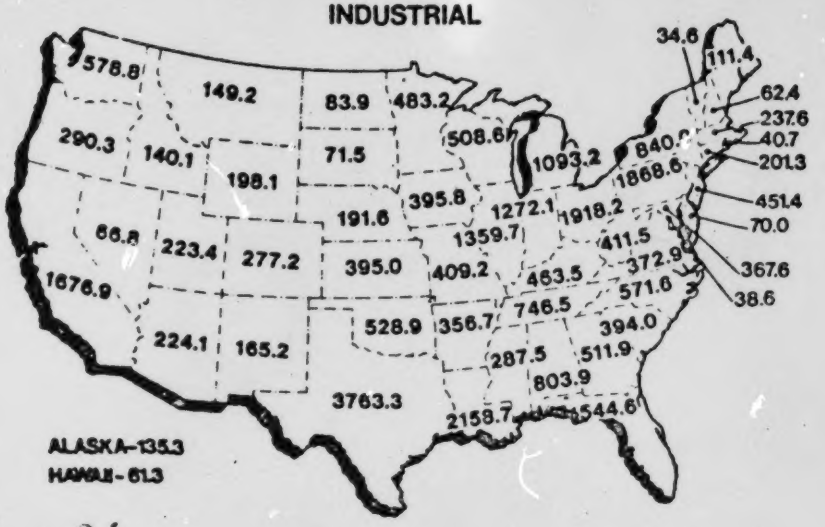
### RESIDENTIAL



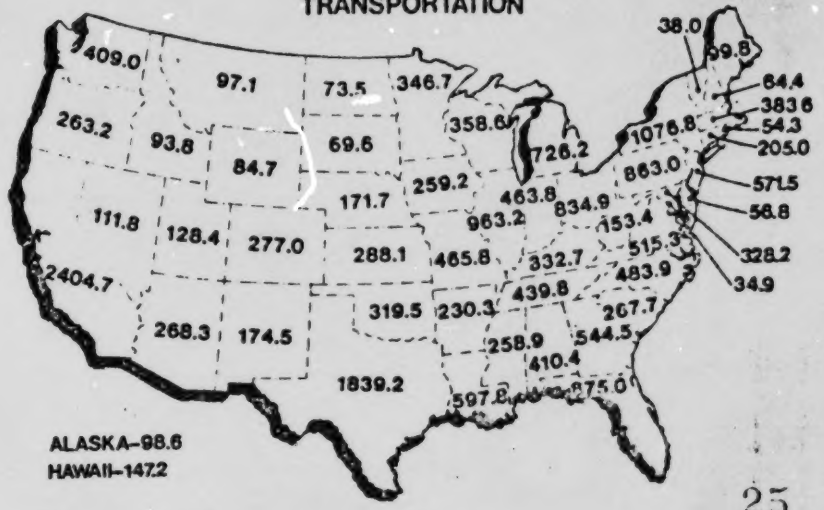

### COMMERCIAL




### INDUSTRIAL




### TRANSPORTATION










Source: US Department of Energy. EBASCO

TITLE: Energy in the Future or Now

CONCEPT: The underlying thought is to assist the students in their recognition that when we speak of the "future" that the "future" is rapidly becoming the present they are to live in.

OBJECTIVE: Students will increase their awareness of some of the "new" energy resources that are now under study and development.

KNOWLEDGE BASE: As we progress year by year, resources are consumed. It should be recognized by the student the factor of scarcity of limited resources. As student recognize resource ultilization they should also understand the complex interrelationships of energy consumption and the environment. Students need to comprehend or learn to think of the environment as a delicately balanced composite of all that encompasses and creates life and of pollution as an upset in that delicate balance.

Activity 1: If feasible, schedule "The Energy-Environment Simulator" for demonstration to class or group counselor/teacher are working with on career unit (e.g., Adv. Bio II, Physics, Chem II classes). Demonstrate the concept to students to assist their cognition of the need for energy research and conservation. (Call Dr. Raymon Hosler, University of Central Florida (305/275-2416) to borrow the simulator.)

Activity 2: Hand-out "Future Energy, The Promoise and The Problems," by Elizabeth Dowling. U.S. Dept. of Energy Book IV: Easy Energy Reader, pp. 9-12. May, 1980. The chart in this article lists benefits and drawbacks of major alternative forms of energy. Discuss with students the advantages and disadvantages of each. Have students state the reasons why they agree or disagree on the use of the energy source

Advantages and Disadvantages of Different Energy Sources

| Energy Source | Advantage | Disadvantage |
|---|---|---|
| COAL | Abundant source; technology developed | Mining coal harms environment, run-off may pollute water; deep mining dangerous for workers; restoring strip-mined land is slow, costly, not always successful; burning high-sulfur coal pollutes air |
| NUCLEAR FISSION | Produces power more cheaply than coal plants; abundant supply of uranium, which fuels nuclear reactors | Nuclear radiation, if leaked, may be fatal; problem of how to dispose of radioactive wastes; nuclear plants are expensive and time-consuming to build |
| NUCLEAR BREEDER REACTOR | "Breeds" more fuel as it burns fuel, so fuel is theoretically inexhaustible | Technology not commercially available before 1990; same (or more) radiation and waste-disposal problems as nuclear fission; since nuclear weapons can be made from its fuel, poses danger if sabotaged by terrorists |
| FUSION | Yields tremendous amount of energy as two atoms are forced to combine; byproducts have very low radioactivity, so fewer problems than other nuclear sources with radiation and waste disposal; unlimited fuel source | Hard to control fusion process; technology won't be available before year 1000, if then |

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Advantages and Disadvantages of Different Energy Sources (cont'd)

| Energy Source | Advantage | Disadvantage |
|---|---|---|
| SOLAR-THERMAL | Sun is an unlimited energy source, creates no harmful radiation or pollution; large areas of Earth get enough sunlight to use solar energy directly for buildings and power; technology now developed on small scale | Low-cost technology not widely available before 1990; costly and inconvenient to convert buildings; solar energy difficult to store and transmit; would need backup energy system if solar storage depleted; not a dependable source in cloudy or cold climates. |
| GEOTHERMAL | Untapped and extensive energy source; power plants take less time to build than coal or nuclear plants; technology already developed in individual cases on small scale | Technology not commercially available before 1980; "hot spots" of steam must be near Earth's surface to avoid need for complex plumbing; steam or hot water might contain polluting minerals which would create disposal problems; Earth's surface might cave in if underground pressure is reduced |
| FUEL CELL | Little pollution because it uses fuel but doesn't burn it; wastes very little heat or gas | Technology not commercially available before 1985 or later |
| TIDAL | Effective in areas of steep tides; some pilot projects in operation | Not effective in areas of low tides or no tides |
| WIND | Technology developed on individual basis; could supply 5–10 percent of U.S. electricity needs by 2000 | Technology still under development; difficult and currently too costly to store and transmit; energy source—wind—is erratic |

PART TWO --

ENERGY CONSERVATION
LESSONS

Clothes dryer

Lint Zephyr

2. Lint Zephyr

50%

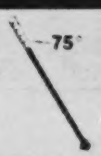
3. 50 percent

more

6. More

Wasteful

7. Wasteful




8. 75 degrees

1/3

0. One-third

8. Rotors

7. Caulk

LESS

6. Less

effi-
cient.

. Efficient

efrigerator
door

Use
Electricity
Wisely

Full

22. Full

filters

21. Filters

Wise

20. Wise

30

19. Lint filter

150
degrees

18. 150 degrees

170
degrees

17. 170 degrees

3 1/2

EER

12. A high EER

Plas-
tic

13. Plastic

A tight-
fitting lid

15. A tight-fitting lid

200 per
cent heating
efficiency

# what's your E.Q.?

**How much do you know about energy? What's your Energy Quotient? To find out, read each statement. Find its correct answer. Then write the number of the answer in the box following the statement.**

A. Slows the movement of heat. ☐

B. Recommended home temperature in winter. ☐

C. Open and close it quickly. ☐

D. A quick shower uses _____ the water of a normal bath. ☐

E. Put it around windows and doors. ☐

F. Maximum temperature for water heater. ☐

G. Insulated drapes can block out _____ of the heat from the sun. ☐

H. Look for it on an air conditioner. ☐

I. What every cooking pan needs on top. ☐

J. Heat Pump. ☐

K. Using the range oven for a heater or toaster is a _____ use of energy. ☐

L. Should be flat-bottomed. ☐

M. Air condition at _____. ☐

N. Clean it after each dryer load. ☐

O. Solid-state appliances use _____ energy than tube types. ☐

P. Vent it to the outside. ☐

Q. Heating and cooling system _____ should be cleaned or replaced every 30 days. ☐

R. Fluorescent lights are at least _____ times more efficent than incandescent lights. ☐

S. Clothes washers and dishwashers are most efficient when washing _____ loads. ☐

T. Small appliances are _____ users of energy. ☐

# Annual/Monthly

Electricity is measured and you are billed by the kilowatthour (kWh). A kWh is equivalent to the electricity used by ten 100-watt light bulbs burning for one hour. To get the approximate operating cost for the appliances listed below, contact your power distributor for your cost per kWh. Then multiply the estimated monthly (or seasonal) kWh by the electric rate.

| | Average kWh Used Annually | Estimated Monthly kWh |
|---|---|---|
| Electric furnace | 13,200* (seasonal) | ..... |
| Heat pump | 6,600** (seasonal) | ..... |
| Quick-recovery water heater | 4,200 | 350 |
| Clothes washer | 1,900*** | 158 |
| Refrigerator/freezer (14-cu. ft. frostless) | 1,800 | 150 |
| Freezer (15-cu. ft. frostless) | 1,800 | 150 |
| Dishwasher | 1,560*** | 130 |
| Air conditioning (Central, per ton) | 1,500 (seasonal) | ..... |
| Air conditioner (Room, one ton) | 1,500 (seasonal) | ..... |
| Freezer (15-cu. ft. manual defrost) | 1,200 | 100 |
| Refrigerator/freezer (14-cu. ft. manual defrost) | 1,200 | 100 |
| Range | 1,200 | 100 |
| Clothes dryer | 1,000 | 83 |
| Color television | | |
| Tube type | 660 | 55 |
| Solid state | 440 | 37 |
| Dehumidifier | 400 | 33 |
| Black & white television | | |
| Tube type | 350 | 29 |
| Solid state | 120 | 10 |
| Attic fan | 300 (seasonal) | ..... |
| Microwave oven | 300 | 25 |
| Roaster | 200 | 17 |
| Frying Pan | 190 | 16 |
| Electric blanket | 150 (seasonal) | ..... |
| Hand iron | 150 | 13 |
| Radio-phonograph | 110 | 9 |
| Coffeemaker | 110 | 9 |
| Trash compactor | 50 | 4 |
| Vacuum cleaner | 50 | 4 |
| Toaster | 40 | 3 |
| Food disposer | 30 | 3 |
| Sun lamp | 20 | 2 |
| Clock | 18 | 2 |
| Mixer | 10 | 1 |
| Toothbrush | 0.5 | 0.04 |

*Based on 1,500-sq. ft. fully insulated house located in a 3,500-degree-day area.

**Heat only.

***Includes kWh for heating water used in these appliances.

For further information, see your local power distributor.

TVA TVA Power Utilization Division

Electricity

## TEACHER'S ANSWER SHEET

# what's your E.Q.?

| Statement Letter | Correct Block |
|---|---|
| A. | 5 — Insulation |
| B. | 11 — 68 degrees |
| C. | 23 — Refrigerator door |
| D. | 29 — Half |
| E. | 27 — Caulk |
| F. | 18 — 150 degrees |
| G. | 3 — 50 percent |
| H. | 12 — A high EER |
| I. | 15 — A tight-fitting lid |
| J. | 16 — 200 percent heating efficiency |
| K. | 7 — Wasteful |
| L. | 4 — Pots & Pans |
| M. | 25 — 78 degrees or higher |
| N. | 19 — Lint filter |
| O. | 26 — Less |
| P. | 1 — Clothes dryer |
| Q. | 21 — Filters |
| R. | 9 — 3½ |
| S. | 22 — Full |
| T. | 24 — Efficient |

**SCORING:**

20, 19, 18 correct answers — Energy Conserver, First Class
17, 16, 15 correct answers — Energy Conserver, Second Class
14, 13, 12 correct answers — Energy Conserver, Third Class
11, 10, 9 correct answers — Energy Conserver, Fourth Class
Below 9 — Go back to basic training

## A TRAVELING SALESMAN

George Pedigo is a traveling salesman representing a shoe manufacturer located in St. Louis, Missouri. He lives in Hardee County, Florida, but most of his customers are in St. Petersburg, Tampa, and the Bradenton-Sarasota area. Many times he must carry a large display case full of sample shoes. The need is present for a large car to make the transportation of the display case easier. He worries a lot about the low gasoline mileage he gets from the use of the large car.

When Mr. Pedigo has to go to St. Louis to meet with the manufacturer and pick up the new samples, he must travel by air. In order to save money and fuel, the airlines have reduced the number of flights between Tampa and St. Louis. This means that Mr. Pedito must often spend an extra night away from home.

The Pedigos have three children, twins age 9 , and an older daughter age 14 years. The twins can ride a school bus to school, but the school board does not provide transportation for the older girl to her junior high school. Up until about six years ago the school board did provide bus transportation for all the students. Most of the time Mrs. Pedigo drives all three children to school in the family's second car which is a small front wheel drive, American-made automobile.

The family lives in a large, old home. The home has two fireplaces and there is an abundant supply of wood available near their Hardee County home, but there is very little insulation, and the three window air conditioners they have, run almost constantly during the summer months. More insulation would probably reduce some energy costs, but it would also cost considerable amount of money.

List as many examples of energy use in the story as you can.

Are there any ways they could reduce the consumption of energy?

What changes in living could the family make and conserve energy?

## USES OF ENERGY

To demonstrate a circle graph set for energy use using the percentage listed for a recent year -

| | |
|---|---|
| Transportation | 26.2% |
| Space heating/cooling | 20.9% |
| Industrial heat | 26.4% |
| Powered machinery | 8.2% |
| Chemicals | 5.1% |
| Water heating | 3.8% |
| Lighting | 2.6% |
| Refrigeration | 2.4% |
| Cooking | 1.1% |
| Other | 3.3% |
| TOTAL | 100 % |

A bar graph could be drawn by the students to discuss the different type graphs.

The discussion should also lead to such questions as which category uses the most energy. Which uses of energy take place in the home? And which home use is the largest percent? Students shoudl give specific uses from each category.

Methods of conserving energy uses would also be a subject of discussion.

## LET'S GO SEE THE BANDITS PLAY

This lesson informs the students of the use transportation makes of our energy.

In 1975 the three largest uses of energy were: Transportation, 26.2%, Space heating/cooling, 20.9%, and Industrial heat, 26.4%. Transportation - using such a major portion of available energy, attempt to show reductions in use for transportation. Consider a trip from Wauchula to Tampa to see a Bandits game.

Begin the activity by checking a Florida map. The distance is approximately 70 miles. Students should have an idea as to the mileage from their experience.

Get various estimates as to the number of gallons it would take for a round trip to the Bandits game. An assignment along this line could be made a couple of weeks in advance and the student could have the parent fill the car with gas and check the number of miles per gallon they are getting.

The students could then determine the savings brought about by 2 persons riding in one automobile. Three persons, four, etc. Have the students compute the amount of savings in energy usage by bus travel, with 30 or 40 passengers.

## HEAT LOSS

In the cooler months a building loses heat through its exterior. The chart below shows the fraction of heat lost from different parts of a house.

| Component | Fraction of Total Heat Loss |
|---|---|
| Exterior walls | 1/8 |
| Ceiling | 3/8 |
| Doors | 1/20 |
| Windows | 3/25 |
| Basement | 2/25 |
| Air leakage | 1/4 |
| Total | 1 |

To re-enforce fractions the students will be instructed to find certain combined heat loss amounts and express as a fraction.

To re-enforce percentage understanding the student will be instructed to convert the fractional loss to a percent. Numerator diveded by the denomintor. Convert the decimal quotient to a percent.

1. Windows and basement
2. Doors and windows
3. Exterior walls and ceiling
4. Ceiling and air leakage
5. Doors and air leakage
6. Exterior walls and basement
7. Ceiling and windows
8. Exterior walls and doors
9. Ceiling and basement
10. Exterior walls and windows
11. Doors and basement
12. Exterior walls and air leakage
13. Doors, windows, and air leakage
14. Exterior walls, ceiling, and air leakage

## CAN WISE FOOD CHOICES SAVE ENERGY?

MATERIALS: - Menu
- Pencil

METHOD:

1. Review the items offered in the menu and select your "first choices" based on your likes and dislikes. Place checks beside those items in Column 1.

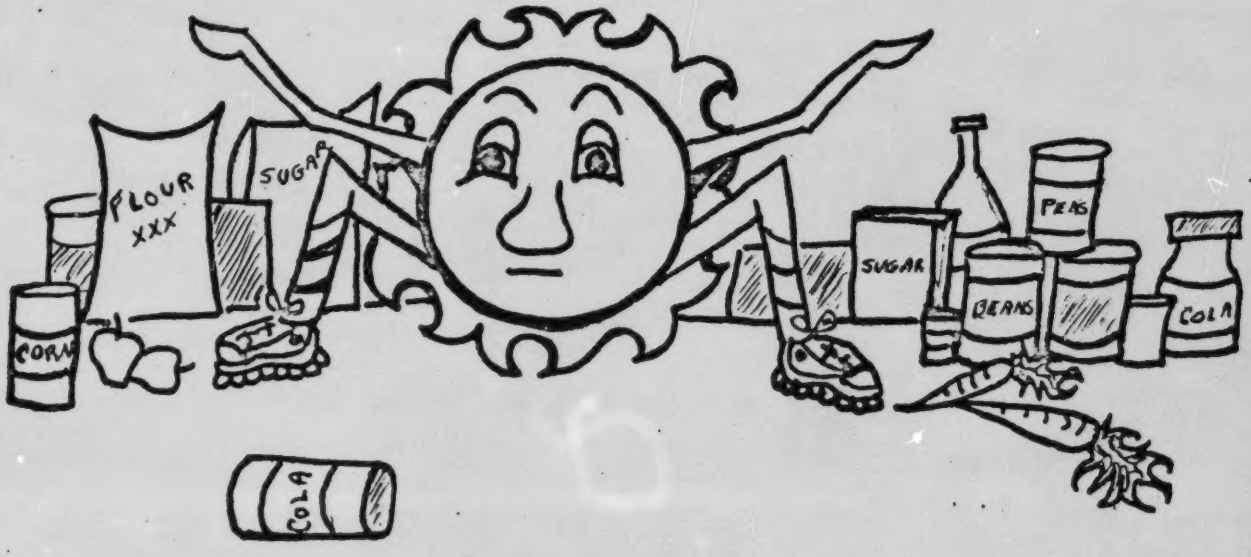
2. Make selections from the menu on the basis of least energy use. Make your decisions with the following in mind: the energy cost of a food includes things like fertilizers, insecticides, equipment, feeds, transportation, processing, packaging, advertising, and preparation. Place a check by each low energy item in Column 2.

3. Now refer to the Energy Price List for each item's energy cost. Show the "price" of each item you chose and determine your total bill.

GETTING IT TOGETHER:

1. Discover how much energy you could have saved by finding the difference between the individual items in the two columns and etner those figures in Column 3. Add the total "pluses and minuses" in this column to find total energy savings.

2. If you were to select items for Column 1 (choices) again, would your choices be any different?



## ENERGY PRICES

(Prices are proportional to actual energy expenditure)

| APPETIZERS | Cents |
|---|---|
| Fresh Orange Juice | .12 |
| Frozen Orange Juice | .46 |
| (Freezing and processing use a great deal of energy, both initially and for storage.) | |
| Cracker A | .10 |
| Cracker B (individually wrapped) | .15 |
| (Food excessively packaged or only available in small packages is more energy-intensive than wrapped foods or foods available in bulk.) | |
| Butter | .15 |
| Margarine | .05 |
| **MAIN DISH** | |
| Luncheon Meat | $1.60 |
| Chicken | .96 |
| Turkey | 1.06 |
| Rice with Vegetables | .45 |
| Beef (grass-fed) | 1.48 |
| Beef (grain-fed) | 2.08 |
| (Animals are inefficient converters of protein. A pound of meat requires about four times the energy to produce and market as a pound of vegetable protein. Some animals are more efficient converters of protein than others.) | |
| **VEGETABLE** | |
| Fresh Carrots | .12 |
| Dehydrated Carrots | .92 |
| Frozen Carrots | .31 |
| Canned Carrots | .23 |
| (Processed vegetables require more energy than fresh vegetables; freezing and dehydration especially require large amounts of energy.) | |
| **DRINKS** | |
| Soft Drink (aluminum can) | .45 |
| Soft Drink (returnable bottle) | .31 |
| Milk | .34 |
| Beer (aluminum can) | .50 |
| Beer (returnable bottle) | .25 |
| **DESSERT** | |
| Homegrown apple | .03 |
| Store-bought apple | .19 |
| (Homegrown apple by commercial methods saves commerce and transport; organic methods would save more.) | |
| Walnuts (shelled) | $1.04 |
| Walnuts (unshelled) | .39 |
| Ice Cream | .60 |
| (Large quantities of milk used; freezing is necessary.) | |

ACTIVITY WORKSHEET

| | | | |
|---|---|---|---|
| **APPETIZERS** (Choose one juice, one cracker & butter or margarine) | | | |
| Fresh Orange Juice | ___ | ___ | ___ |
| Frozen Orange Juice | ___ | ___ | ___ |
| Cracker A | ___ | ___ | ___ |
| Cracker B-wrapped individually | ___ | ___ | ___ |
| Butter | ___ | ___ | ___ |
| Margarine | ___ | ___ | ___ |
| **MAIN DISH** (Please make a First & Second choice as we do not always carry each entree) | | | |
| Luncheon Meat | ___ | ___ | ___ |
| Chicken | ___ | ___ | ___ |
| Turkey | ___ | ___ | ___ |
| Rice with Vegetables | ___ | ___ | ___ |
| Beef (grass-fed) | ___ | ___ | ___ |
| Beef (grain-fed) | ___ | ___ | ___ |
| **VEGETABLE** (Sorry, today we have only carrots, but you may choose your preferred type.) | | | |
| Fresh Carrots | ___ | ___ | ___ |
| Dehydrated Carrots | ___ | ___ | ___ |
| Frozen Carrots | ___ | ___ | ___ |
| Canned Carrots | ___ | ___ | ___ |
| **DRINKS** (Please choose a First & Second choice as we sometimes run short of one kind of drink at lunch) | | | |
| Soft Drink (in aluminum can) | ___ | ___ | ___ |
| Soft Drink (in returnable glass bottle) | ___ | ___ | ___ |
| Milk | ___ | ___ | ___ |
| Beer (in aluminum can) | ___ | ___ | ___ |
| Beer (in returnable glass bottle) | ___ | ___ | ___ |
| **DESSERT** (Choose one) | | | |
| Apples (Homegrown in our cafeteria's own garden) | ___ | ___ | ___ |
| Apples (store-bought) | ___ | ___ | ___ |
| Walnuts (shelled) | ___ | ___ | ___ |
| Walnuts (unshelled) | ___ | ___ | ___ |
| Ice Cream | ___ | ___ | ___ |
| TOTAL BILL | ___ | ___ | ___ |

## FOOD CONSUMED AND ENERGY USED TO PRODUCE THAT FOOD IN HARDEE COUNTY, FLORIDA

GIVEN: The energy necessary to produce food products consumed in one year by one person

| Plant Product | Food Consumed (lbs/person/year) | Energy Required to Produce Food (gal. oil/person/year) | Ratio (lbs/gals) |
|---|---|---|---|
| Flour & cereal | 140.0 | 2.2 | 64 |
| Sugar | 122.0 | 1.4 | |
| Vegetable oils | 41.8 | 3.7 | |
| Fruits | 131.5 | 1.9 | |
| Potatoes | 104.9 | 0.6 | |
| Beans, Peas & Nuts | 16.1 | 1.8 | |
| Green & Yellow Vegetables | 215.1 | 2.3 | |
| Miscellaneous | 14.8 | 0.2 | |
| **Animal Products** | | | |
| Beef | 116.0 | 19.1 | |
| Dairy | 356.0 | 4.7 | |
| Pork | 67.4 | 4.8 | |
| Animal Fats & Oils | 14.6 | 3.5 | |
| Poultry | 52.4 | 1.6 | |
| Eggs | 39.0 | 1.3 | |
| Veal and Lamb | 5.5 | 0.8 | |
| Fish | 15.2 | 2.1 | |

This data can be used in several ways in math class. By dividing food by energy the rate of lbs. per gallon can be determined. Other matters would then be introduced to come up with the 64. Rounding a repeating decimal to the nearest whole number, etc., the total Plant Products can be ascertained and the ratio computed.

Total - 786/14.1 with a rate of 55.7 pounds produced per each gallon of oil.

The same thing for Animal Products.

Total - 666.1/37.9 with a rate of 17.6 pounds produced per each gallon of oil.

The foods requiring the most gallons of oil may be determined from the preceding chart. After these general discussions the subject of how much of each food would be consumed by the population of Hardee County.

Discuss the population of the county. I would say approximately 20,000. Let the students multiply the amount of food consumed by an individual by the total number in the county. Same for gallons of oil needed to produce that amount of food. Ths could also be extended to the entire state of Florida (Population: 10 million?)

Have the students prepare an "Energy diet" for the people of Hardee County.

# HOME ENERGY USE

## INTRODUCTION

Do you know how much energy is used in your home in one day? Do you know where this energy comes from? Knowing the answers to these questions can help you understand both the importance of energy in your daily life and the problem of energy conservation in your home.

In this activity you will measure the energy used in your home. You will collect data that will show you when your family uses most of its energy and how it uses this energy. With this information you can begin to examine ways for your family to conserve energy. Would your family members be willing to change the way they live in order to conserve energy? Would they spend money on energy conservation? Have your family members already begun to change the way they live to save on energy costs?

## OBJECTIVES

At the completion of this activity you should be able to:

- o recognize and understand the units in which energy is measured.
- o read electric and/or gas utility meters.
- o determine how much energy your family uses in a two month period.
- o determine for what purposes various amounts of energy are used in your home.
- o calculate heating degree days.
- o recognize the types of systems used to produce heat and hot water.

## SKILLS AND KNOWLEDGE YOU NEED

- How to do basic arithmetic.
- How to graph data.
- How to keep a daily journal.

## MATERIALS

- A notebook.
- Access to utility meters in your home.
- Utility bills (optional, with your parents' consent).

## METHOD

1. For the next two months keep a <u>daily</u> record of the information below in your notebook/journal.

   a. Weather conditions, including:

      - temperature (high and low)
      - wind
      - heating degree days
      - cloud cover or approximate hours of sunshine

   b. Utility meter readings (See practice worksheet for help in reading meters.)

c. The pattern of energy use in your home, such as:

- thermostat setting
- number, wattage, and length of time electric lights are on
- length of time electric appliances are run
- number of showers and baths

d. Any change in the pattern of home energy use such as a new stove, a refrigerator, or an additional television.

2. At the same time, keep a weekly record of the information below. Use only that information which is appropriate to your home.

a. fuel oil consumption

b. bottled gas consumption

c. wood consumption

3. Place your home's weekly energy data in the appropriate column on the next page.

CF = cubic feet (of natural gas)
KWH = kilowatt hours of electricity
BTU = British Thermal units of heat energy
LP = pounds of liquid propane (bottled gas)

4. To complete the table you must convert the amount of each kind of energy used to BTU's. The following chart provides the energy equivalents.

1 KWH = 3,413 BTU's
1 gallon #2 fuel oil = 145,000 BTU's
1 CF = 1,031 BTU's
1 lb. bottled gas = 21,700 BTU's
1 cord of wood = approximately 21,000,000 BTU's for hardwood, 13,000,000 BTU's for softwood

5. Record the weekly summary of energy use in a graph. Plot week versus total BTU's. Compare your results to the results of other students in the class.

6. Construct separate graphs, in the same way as the one above, of the total weekly energy use in BTU's for each energy source. Compare these graphs to one another and to those of other students in the class.

7. Construct a graph of total heating degree days for each week. Compare these graphs to the others you have constructed. Your teacher will instruct you how to find the heating degree days.

WEEKLY HOME ENERGY USE

| Week | Dates | CCF | BTU's | Fuel Oil (gallons) | BTU's | LP (lbs.) | BTU's | KWH | BTU's | TOTAL BTU's |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 | | | | | | | | | | |

8. (optional) With your parents' permission, keep a monthly record of the amount of money spent on each kind of energy used. If you have data for several months, construct a graph of amount spent versus month.

## LOOKING BACK

You have kept a daily journal of your family's energy needs and use over a long period of time. This information should give you a good start towards understanding the importance of energy to your family's well-being. It should also help you understand the seriousness of our nation's "energy crunch", and perhaps it can help you determine ways in which your family can help to solve the problem of energy conservation.

## QUESTIONS

1. According to your graph of total energy consumption, what conclusions can you draw about your home's total energy use over time?

2. Compare your individual graphs of energy consumption for electricity, fuel oil, natural gas, etc. to one another. What conclusions can you draw from the graphs about your energy use relationships?

3. In terms of total BTU's, which energy source supplies most of the energy needs in your home? For what particular purpose do you think most of this energy is used? Why?

4. According to your graphs, when was your home's energy use the greatest? What are some reasons for this?

5. According to your graphs, when was your home's energy use the least? What are some reasons for this?

6. What are some changes you think your family could make to reduce the amount of energy it uses?

## GOING FURTHER

- With your family's agreement, implement a plan to reduce your energy requirements. Continue to record your energy use in your journal. After several weeks, compare these new data with your original energy data to see if your energy requirements actually were reduced.

- Expand your energy journal to include automobile and gasoline use. Keep track of all trips made by automobile in your family. Record the destination, miles, and the number of gallons of gasoline used. Determine the number of miles per gallon for each of your family's automobiles. Plan some conservation measures for automobile use.

- Determine whether part of your family's energy needs could be met by alternate means such as the installation of solar panels. Do research to find out such things as:

  a. Total BTU required for hot water and home heating.

  b. Solar panel output:

     - The number of solar panels required to meet your families' needs.

     - The cost of solar panels, including installation.

     - The life expectancy of solar panels.

  c. Compare the above yearly cost for solar energy with your fuel costs. Include an inflation factor in your calculations.

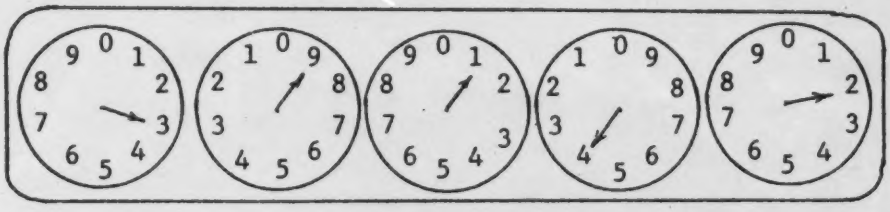
  d. Would it be worthwhile to install solar panels in your home?

- Do an energy survey of your school. Follow the same steps as you used when surveying your home.

# READING AN ELECTRIC METER

Electrical meters measure electricity in Kilowatt-hours (KWH). The meters are usually read monthly (or bimonthly) by a representative from your local electric company, so that the company knows how much to bill you for your electric use.

To learn how to read an electric meter yourself, look at the sample meter shown below.



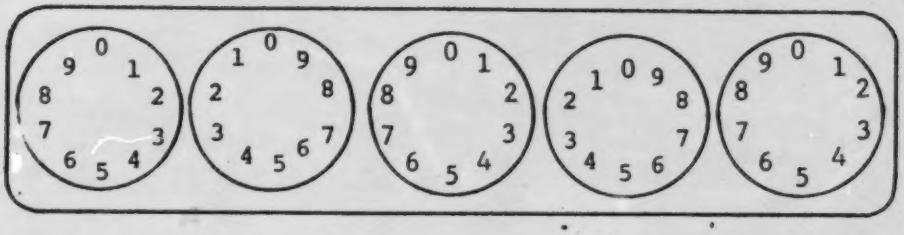
Notice that some of the dials read clockwise and some read counter-clockwise. Start at the left and read the number to which the needle points. If the needle is between two numbers, take the reading of the lower number.

What is the number of kilowatt-hours shown on the dial above?

_____ _____ _____ _____ _____ KWH

Now take the next page home with you and fill in the blank dials with the reading from your own electric meter. If your meter is different than the one shown, carefully copy the dials from your meter exactly as they appear, and then draw each needle on the dial as it appears on your meter. (Do this on a separate sheet of paper.)

Then read your meter again one day later. Try to read the meter at the same time as the day before.



DATE: _____

TIME: _____

METER READING #1 _____KWH

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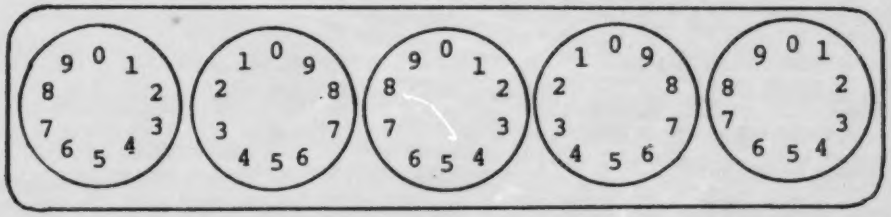


DATE: _____

TIME: _____

METER READING #2 _____KWH

---

If you subtract meter reading #1 from meter reading #2, you will know how much electricity your home used in one day.

Meter reading #2 = _____KWH

Meter reading #1 = _____KWH

(subtract) _____KWH = your electric use for one day

Teacher Information Sheet

# HOME ENERGY USE

Suggested Grade Level and Discipline

9-12 Physical Science
Earth Science, Advanced Junior High School
Consumer Education, Human Ecology
Math
Adult Education

Background Information

Most families use more than one kind of energy to meet their home energy needs. Common combinations include natural gas and electricity, fuel oil and electricity, or some combination with bottled gas; although newer homes may be all-electric, and wood increasingly is being used as an auxiliary energy source. Since these kinds of energy are commonly measured in different units, it becomes a problem to compare the proportion of energy used among the different sources. This problem can be solved by converting each energy unit to a single common unit.

The most common unit for measuring heat energy is the British Thermal Unit (BTU). It is defined as the amount of heat necessary to raise the temperature of one pound of water one degree Fahrenheit from 39°F to 40°F. Most engineering work is done in BTU's as is the output rating of most heating systems. Therefore, students are given the energy equivalents to convert each kind of energy to BTU's, so that they are able to compare data.

The common units of energy use are:

kilowatt-hour for electrical use
cubic foot for natural gas
gallon for fuel oil
pound for bottled gas (LP)
cord for wood (A cord is a stack of wood measuring 4' x 4' x 8', or 120 cubic feet of wood. This is an inexact unit.) This is a full cord, a face cord consists of a pile 1/3 the size of a full cord.

If you prefer to use a metric unit for energy use, then the standard unit for heat is the calorie, although the kilocalorie is commonly found in the literature. A calorie is defined as the amount of heat necessary to raise the temperature of one gram of water one degree Celsius, from 14.5°C to 15.5°C. A kilocalorie is 1,000 calories. The conversions to kilocalories for each kind of energy are:

1 kilowatt-hour = 860.1 kilocalories
1 gallon #2 fuel oil = 43,776 kilocalories
1 cubic foot natural gas = 259.8 kilocalories
1 pound bottled gas = 5,465 kilocalories
1 cord wood = 5,289,673 kilocalories for hardwood
3,274,559 kilocalories for softwood

NOTE: for all woods BTU's per pound = 5,790; kcal per pound = 1,459

To help you understand what this answer means, 1 kilowatt = 1,000 watts. Therefore, 1 kilowatt-hour is equal to ten 100-watt bulbs burning for 1 hour.

NOTE: Look for a meter-multiplier on all meters. Some electric meters may only have 4 dials. These meters should have a meter-multiplier factor of 10. The meter should state on it (x 10). If this is so, then the number read from the dials must be multiplied by 10 to arrive at kilowatt hours.

If you have a gas meter, it is read in essentially the same way, except that the smallest quantity of gas measured by most gas meters is 100 cubic feet. Therefore, gas meter readings must be multiplied by 100 to arrive at cubic feet.

Since space heating tends to be a major use of energy in the home, the concept of heating degree days can be helpful in a survey of home energy use. The number of heating degree days is a measure of the amount of heat that will be needed for space heating purposes. Comparison of heating degree days from week to week or month to month can help to determine the proportion of energy used for space heating.

Heating degree days (HDD) are calculated in the following way:

1. In general heat is not required when the mean $\frac{(\text{high} + \text{low})}{2}$ outdoor temperature is $65^{\circ}F$ or above.

2. The formula for heating degree days for a given day is $65^{\circ}F$ minus the mean outdoor temperature. For example, on a given day, if:

   the high = $40^{\circ}F$
   and the low = $20^{\circ}F$
   then the mean = $\frac{40 + 20}{2} = 30^{\circ}F$

   thus, heating degree days = 65 - 30 = 35.

3. Total HDD over a period of time are found by adding the results for each day.

Heating degree day information may be obtained from a local weather station, a local oil dealer, or your gas and electric company.

Hints on Gathering Material

- Announce in advance of the activity that a notebook will be needed for keeping a journal.
- If possible, obtain a gas or electric meter to use as a classroom demonstrator. Contact your local utilities.
- The Data Table for energy use can be duplicated and handed out to students as the activity begins. (If wood is used as an energy source, it must be added to the table.)

Suggested Time Allotment

- Introduction of the activity, including an explanation of journal keeping, of units of energy, and of heating degree days; 1 class period.
- Use of the practice worksheet on reading meters; part of 2 class periods by 1 day.
- Part of one class per week to work on the journal, to record data, and to work on converting energy units.
- One to two class periods to prepare graphs. (Some of this could be done as homework assignments.)

- One to two class periods to compare and discuss differences among student graphs, to discuss possible reasons for the differences, and to discuss energy conservation methods and their possible effects.

Suggested Approach

- The length of time devoted to journal keeping may vary depending on the interest level of the students.
- Parts of the activity may be used, depending on the ability and interest levels of the students.
- Carefully introduce the concept of journal-keeping if students have not been exposed to it before.
- Discuss energy units and heating degree days as the activity is introduced.
- The practice worksheet on meter reading can be used at the start of the activity to insure that students are able to read their utility meters.
- Demonstrate making energy conversions to BTU's and allow for practice time in making conversions.
- Give students help in plotting data on graphs.
- For career and consumer education infusion, representatives from the energy field may be invited into the classroom to discuss various aspects of the activity. An electrical utility representative can discuss how electrical energy is used in the home. A fuel oil distributor could discuss his company's relationship to home energy use. Individuals involved in energy conservation could discuss conservation measures such as auxiliary heating with wood, solar heating, insulation, etc.

Typical Results

- Results will vary depending on geographic location and time of year.
- Results will also vary depending on the source of energy used for space heating. Depending on geographic location, electricity, fuel oil, or natural gas will be used for space heating.

Precautions

- *Some students may not have access to utility meters, especially if they live in apartment houses.*
- *Some parents may regard this activity as an invasion of privacy. A statement to parents of the activity's purpose, along with permission slips to be signed by parents, is suggested.*

- *Not all utility meters are alike. Contact your utility company for the kind of meters used in your locality.*

- *Student interest may lag during a long-term investigation such as this; therefore a weekly update session may be important.*

## Modification

- Keep a record of the energy consumed by the school. Could conservation methods be practiced here?

## Evaluation

- Observe your students' ability to keep daily journals as the activity progresses.

- Collect and review the data gathered by each student. Was the data table carefully and correctly filled in? Were the graphs well-organized and usable for data analysis?

- Are the answers to the questions requiring analysis of the graphs well thought out?

## References


- *Save Energy, Save Dollars,* Efficient Energy Management for Consumers (Cornell University, Ithaca, New York. Bulletin 125. $1.50)

- *Heating Degree Days,* Ray Falconer. (Atmospheric Sciences Research Center, State University of New York at Albany. Publication No. 432).

- *Energy Conservation, Homes & Buildings.* National Science Teachers Association, Factsheet #9. (Available from the Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830).

- *Kill A Watt,* Award Winning Energy Education Activities. National Science Teachers Association. (Available from the Department of Energy, Technical Information Center).

- *Your Energy Efficient House,* A. Adams. (Charlotte, Vermont: Garden Way Publishing Co.)

Take the class or group to your high school career/occupational resource center. Using the occupation #350 Meter Reader as an example, introduce the student to the format for the Florida Center for Career Development Services System: The job title, location, job duties, working conditions, hours of work, usual fringe benefits, job characteristics, personal, scholastic aptitudes, physical traits, you shall know that, economic returns, things to think about, where will you work, job outlook, job advancement, related occupations, for more information education required, more facts and Florida training sites: Area vocational technical centers, community colleges, and public universities. It is suggested when demonstrating the reader to the students, that they have a printed copy of the microfiche being demonstrated in the reader. NOTE: This activity is the prelude to further awareness, exploration and in-depth projects regarding careers in energy and enviornmental concerns. Therefore, it is imperative that the student knows how to use this system. Take each part of the printed copy and explain that all occupations within the system have the same format.

FLORIDA CENTER FOR CAREER DEVELOPMENT SERVICES
Department of Education
Knott Bldg. Tallahassee, Florida 32301 904/488-0400

JOB TITLE: METER READER
OCC#: 350
DOT#: 209.567.010
SOC#: 4755-205
REVISED DATE: July, 1982
This information valid until: August, 1983

## THE JOB 1

Meter Readers work for utility companies, reading meters that measure the amount of water, gas or electricity used.

### Job Duties:

1. Reads meters that measure the usage of water, gas, or electricity.
2. Records the reading on customer account forms.
3. Determines the amount used by subtracting the last reading from the present one.
4. Follows a prescribed route.
5. Covers his/her route on foot. (In the rural areas and industrial areas the Meter Reader drives a vehicle from location to location).
6. Meets customers and answers routine questions.
7. Keeps the meter book up-to-date.
8. Reports on the day's work.

### Working Conditions:

-Must spend most of the day walking and standing.
-Must work out-of-doors in bad weather.
-Must read meters often located in cramped places.

### Hours of Work:

-Usually 40 hours per week.
-Overtime is sometimes required.

**Usual Fringe Benefits:** - Can include paid sick leave, paid vacation, retirement plans, injury and disability benefits, paid holidays, group health and life insurance plans.





## MATCHING THIS JOB TO YOU

### Job Characteristics:

**Personal Interests**

You should like to:
-Work in an organized regular way
-Repeat the same task over and over
-Meet exact standards on the job

**Scholastic Aptitudes**

Required: High school diploma
-Remember things well
-Understand instructions
-Catch on quickly
-Write reports
-Talk easily with people
-Understand words & ideas
-Pay attention to detail
-Do neat & quick work
-Follow written instructions

**Physical Traits**

You must be able to:
-Stand for long periods
-Lift 10-20 pounds
-Pinch, pick, work mainly with the fingers
-Reach and stretch
-See clearly
-Judge distance & shapes
-Identify colors

### You Should Know That:

-Some companies require Meter Readers to wear a uniform.
-You must be able to walk all day as a normal part of the job.
-A physical exam and driver's license may be required.
-Some companies require a bond.
-You may be attacked and bitten by dogs.

### Economic Returns:

| | |
|---|---|
| Earnings Range | $3.35 - $5.50/hour |
| Most workers earn | $3.45 - $5.50/hour |
| Usual starting salary | $3.35 - $4.00/hour |

Please Note...Not all employers are required to pay the Federal Minimum Wage. For specific information about employers in your area contact your local office of the U.S. Department of Labor, Wage and Hour Division. Your counselor or occupational specialist can help. Or, write us and we'll send this information to you.

### Things to Think About:

-Good fringe benefits.
-Job security.
-Good pay in relation to the required education and training.
-In some areas this job is under civil service.
-Work in all kinds of weather.
-May have to enter poorly kept buildings and meet unfriendly dogs.
-Job can be boring.

# PROSPECTS & OPPORTUNITIES 3

## Where You Will Work:

Meter Readers work for water, gas and electric companies.

## Job Outlook:

1. There is not a great demand for Meter Readers.
2. Most openings occur due to promotion and retirements.
3. The FD of ES estimates that there will be an average of 62 openings per year statewide for all Meter Readers between 1980-1990.

## Job Advancement:

1. Some Meter Readers advance to Supervisory positions.
2. Others transfer to jobs such as Route Collector, Field Service Representative, or Customer Service Representative. These jobs offer more pay and more chance to be promoted.

## Related Occupations:

-Plotting Board Operator
-Router
-Inspection Clerk
-Chief Meter Reader
-Collective Clerk
-Parking Meter Collector
-Coin Machine Collector
-Telephone Collector
-Mail Carrier

## For More Information:

-Check with local utilities in your Yellow Pages.





# PREPARATION & TRAINING

## EDUCATION REQUIRED:

| High School | College or Technical Training: |
|---|---|
| [illegible] | 1 2 3 4 or More |

1. The Meter Reader must have a high school diploma.
2. High school courses should include Mathematics, English, Shop and Public Speaking.
3. Most utility companies provide on-the-job training.
4. Additional education will increase employment and advancement opportunities.
5. A physical examination and driver's license may be required.
6. Some companies require a bond.

## More Facts:

No training for this job has been identified by Florida View in:

1. Florida vocational-technical centers
2. Public two-year colleges
3. Public or private 4-year institutions

Training opportunities may exist in private vocational schools, through on-the-job training, or out of state. See your Guidance Counselor or Occupational Specialist for advice.

# PROSPECTS & OPPORTUNITIES 3

## Where You Will Work:

Meter Readers work for water, gas and electric companies.

## Job Outlook:

1. There is not a great demand for Meter Readers.
2. Most openings occur due to promotion and retirements.
3. The FD of ES estimates that there will be an average of 63 openings per year statewide for all Meter Readers between 1980-1990.

## Job Advancement:

1. Some Meter Readers advance to supervisory positions.
2. Others transfer to jobs such as Route Collector, Field Service Representative, or Customer Service Representative. These jobs offer more pay and more chance to be promoted.

## Related Occupations:

-Plotting Board Operator
-Router
-Inspection Clerk
-Chief Meter Reader
-Collective Clerk
-Parking Meter Collector
-Coin Machine Collector
-Telephone Collector
-Mail Carrier

## For More Information:

-Check with local utilities in your Yellow Pages.





# PREPARATION & TRAINING

## EDUCATION REQUIRED:

High School

College or Technical Training:
1 2 3 4 or More

1. The Meter Reader must have a high school diploma.
2. High school courses should include Mathematics, English, Shop and Public Speaking.
3. Most utility companies provide on-the-job training.
4. Additional education will increase employment and advancement opportunities.
5. A physical examination and driver's license may be required.
6. Some companies require a bond.

## More Facts:

No training for this job has been identified by Florida View in:

1. Florida vocational-technical centers
2. Public two-year colleges
3. Public or private 4-year institutions

Training opportunities may exist in private vocational schools, through on-the-job training, or out of state. See your Guidance Counselor or Occupational Specialist for advice.

# FLORIDA TRAINING SITES 5

**NOTE: The Solid Dots have Training for this Occupation.**

## Area Vocational Technical Centers:

| | | | | | |
|---|---|---|---|---|---|
| ● | 1. | Atlantic Vocational Technical Center | 4700 Coconut Creek Parkway | Coconut Creek 33066 | 305/975-6220 |
| ● | 2. | Bay Area Vo-Tech Center | 1970 Lewis Turner Blvd. | Ft. Walton Beach 32548 | 904/862-0107 |
| ○ | 3. | Brevard Union Area Voc Tech Center | 639 N. Orange Street | Starke 32091 | 904/964-8150 |
| ○ | 4. | Charlotte Vocational Technical Center | 1668 Toledo Blade | Port Charlotte 33953 | 813/629-6819 |
| ● | 5. | Collier County Vocational-Technical Center | 2975 Exey Avenue | Naples 33963 | 813/774-8626 |
| ○ | 6. | Erwin Vocational Technical Center | 3010 East Hillsborough | Tampa 33610 | 813/238-0631 |
| ● | 7. | Thomas P. Haney Vo-Tech | 3016 Highway 77 | Panama City 32405 | 904/769-2191 |
| ● | 8. | Lake County Area Vocational-Technical Ctr | 2001 East Street | Eustis 32726 | 904/357-8323 |
| ○ | 9. | Lee County Voc Tech Center | 2800 Michigan Avenue | Fort Myers 33905 | 813/334-4544 |
| ● | 10. | Lindsey Hopkins Educational Center | 1410 N.E. Second Avenue | Miami 33132 | 305/350-3254 |
| ● | 11. | Lewis M. Lively Area Voc Tech Center | 500 N. Appleyard Drive | Tallahassee 32304 | 904/576-3161 |
| ● | 12. | Bedford M. Lochlin Voc Tech Center | 5210 Berryhill Road | Milton 32570 | 904/626-1919 |
| ● | 13. | Manatee Area Vocational Technical Center | 5603 34th Street West | Bradenton 33507 | 813/755-1641 |
| ● | 14. | Miami Lakes Technical Educational Center | 5780 N.W. 158th Street | Miami Lakes 33014 | 305/557-1100 |
| ● | 15. | Mid Florida Technical Institute | 2900 W. Oak Ridge Road | Orlando 32809 | 305/855-5880 |
| ● | 16. | Mirror Lake Tomlinson Adult Vocational Ctr | 909 Mirror Lake Drive | St. Petersburg 33701 | 813/821-4593 |
| ● | 17. | Robert Morgan Vocational Technical Center | 18180 S.W. 122nd Avenue | Miami 33177 | 305/253-9470 |
| ● | 18. | North Technical Education Center | 7071 Garden Road | Riviera Beach 33404 | 305/848-0854 |
| ● | 19. | Orlando Vocational Technical Center | 301 W. Amelia Street | Orlando 32801 | 305/425-3750 |
| ● | 20. | Pinellas Vocational Technical Institute | 6100 154th Avenue, North | Clearwater 33520 | 813/531-3331 |
| ○ | 21. | Polk County Area Vocational Technical Ctr | P.O. Box 720 | Lakes Park 33860 | 813/965-1220 |
| ● | 22. | Ridge Vocational-Technical Center | 7700 State Road 544 | Winter Haven 33880 | 813/422-8401 |
| ○ | 23. | St. Augustine Technical Center | Collins Ave at Del Monte Dr. | St. Augustine 32084 | 904/824-4401 |
| ● | 24. | St. Petersburg Voc Tech Institute | 901 34th Street South | St. Petersburg 33711 | 813/327-2871 |
| ○ | 25. | Sarasota County Voc Tech Center | 4748 Beneva Road | Sarasota 33581 | 813/924-1383 |
| ● | 26. | Sheridan Vocational Technical Center | 5400 Sheridan Street | Hollywood 33021 | 305/963-6653 |
| ● | 27. | South Technical Education Center | 1950 S.W. 50th Avenue | Boynton Beach 33435 | 305/278-0384 |
| ● | 28. | George Stone Area Voc Tech Center | Route 10 Box 530 | Pensacola 32506 | 904/944-1424 |
| ● | 29. | Suwannee-Hamilton Area Voc Tech Center | 415 S.W. Pinewood Drive | Live Oak 32060 | 904/362-2252 |
| ● | 30. | Tampa Bay Voc Tech Center | 4810 Orient Road | Tampa 33610 | 813/621-2441 |
| ○ | 31. | Taylor County Area Voc Tech Center | 3233 Highway 19, South | Perry 32347 | 904/584-7605 |
| ● | 32. | Washington-Holmes Area Voc Tech Center | 209 Hoyt Street | Chipley 32428 | 904/638-1180 |
| ○ | 33. | Webster Adult Education Center | 901 Webster Avenue | Winter Park 32789 | 305/647-6266 |
| ● | 34. | Wekeeva Vocational Technical Center | 951 E. Story Road | Winter Garden 32787 | 305/656-2831 |
| ○ | 35. | West Technical Education Center | 5625 State Road 715 | Belle Glade 33430 | 305/996-4750 |
| ● | 36. | Whitesmarsh Area Voc Tech Center | 1889 W. Main Street | Inverness 32650 | 904/726-2430 |

## Community Colleges:

| | | | | | |
|---|---|---|---|---|---|
| ● | 80. | Broward Community College | 1319 Coconlake Road | Coconut 33073 | 305/435-1111 |
| ● | 81. | Broward Community College | 225 E. Las Olas Blvd. | Ft. Lauderdale 33301 | 305/761-7463 |
| ● | 82. | Central Florida Community College | P. O. Box 1388 | Ocala 32670 | 904/237-5111 |
| ● | 83. | Chipola Junior College | College Street | Marianna 32446 | 904/526-2761 |
| ○ | 84. | Daytona Beach Community College | P. O. Box 1111 | Daytona Beach 32015 | 904/255-8131 |
| ● | 85. | Edison Community College | College Parkway | Fort Myers 33907 | 813/489-9318 |
| ● | 86. | Florida Jr. College at Jacksonville | 21 West Church Street | Jacksonville 32202 | 904/358-1413 |
| ● | 87. | Florida Keys Community College | One Junior College Road | Key West 33040 | 305/296-9081 |
| ● | 88. | Gulf Coast Community College | 5230 W. Highway 98 | Panama City 32401 | 904/769-1551 |
| ○ | 89. | Hillsborough Community College | P. O. Box 22127 | Tampa 33622 | 813/879-7222 |
| ● | 90. | Indian River Community College | 3209 Virginia Avenue | Fort Pierce 33454 | 305/464-2000 |
| ● | 91. | Lake City Community College | Route 7 Box 42 | Lake City 32055 | 904/752-1822 |
| ● | 92. | Lake Sumter Community College | 5908 U.S. 441 South | Leesburg 32748 | 904/787-3747 |
| : | 93. | Manatee Junior College | P. O. Box 1849 | Bradenton 33506 | 813/755-1511 |
| ● | 94. | Miami Dade Community College | 11011 S.W. 104th Street | Miami 33176 | 305/596-1365 |
| ● | 95. | North Florida Junior College | Turner Davis Drive | Madison 32340 | 904/973-2288 |
| ● | 96. | Okaloosa Walton Junior College | 100 College Blvd. | Niceville 32578 | 904/678-5111 |
| : | 97. | Palm Beach Junior College | 4200 Congress Avenue | Lake Worth 33461 | 305/439-8105 |
| : | 98. | Pasco Hernando Community College | 2401 S. Highway 41 North | Dade City 33525 | 904/567-6761 |
| : | 99. | Pensacola Junior College | 1000 College Blvd. | Pensacola 32504 | 904/476-5410 |
| : | 70. | Polk Community College | 999 Avenue N Northeast | Winter Haven 33880 | 813/294-7771 |
| : | 71. | St Johns River Community College | 5001 St Johns Avenue | Palatka 32077 | 904/328-1517 |
| : | 72. | St. Petersburg Junior College | P. O. Box 13489 | St. Petersburg 33733 | 813/546-0021 |
| : | 73. | Santa Fe Community College | P. O. Box 1530 | Gainesville 32602 | 904/377-5161 |
| : | 74. | Seminole Community College | | Sanford 32771 | 305/323-1450 |
| : | 75. | South Florida Junior College | 809 W. College Drive | Avon Park 33825 | 813/453-6661 |
| : | 76. | Tallahassee Community College | 444 Appleyard Drive | Tallahassee 32301 0178 | 904/576-5161 |
| : | 77. | Valencia Community College | P. O. Box 3028 | Orlando 32802 | 305/299-5000 |





# FLORIDA TRAINING SITES CONT. 6

## Public Universities:

| | | | | | |
|---|---|---|---|---|---|
| ○ | 78. | Florida A&M University | Martin Luther King Jr. Blvd. | Tallahassee 32307 | 904/599-3798 |
| ○ | 79. | Florida Atlantic University | | Boca Raton 33431 | 305/395-3040 |
| ○ | 80. | Florida International University | Tamiami Trail | Miami 33199 | 305/553-2020 |
| ○ | 81. | Florida State University | | Tallahassee 32306 | 904/644-6200 |
| ○ | 82. | University of Central Florida | | Orlando 32816 | 904/275-2383 |
| ○ | 83. | University of Florida | | Gainesville 32611 | 904/392-1383 |
| ○ | 84. | University of North Florida | 4567 St. Johns Bluff Rd. South | Jacksonville 32216 | 904/646-2934 |
| ○ | 85. | University of South Florida | 4202 Fowler Avenue | Tampa 33620 | 813/974-3350 |
| ○ | 86. | University of West Florida | | Pensacola 32504 | 904/474-2660 |

## Private Education and Other Training Sites:

**Need help locating a job in this career field? Ask your occupational specialist or guidance counselor about CAPS Cooperative Agency Placement System.**

## TEST YOURSELF . . . YOUR ENERGY CHECKLIST

**No doubt you are now trying to conserve energy. This checklist will help you recognize the energy conservation practices you now use, and identify ways you can become an even better energy manager.**

| Have Done | Will Do | |
|---|---|---|
| | | **Insulation Reduces Heat Loss or Heat Gain, Improves Comfort, and Reduces Energy Required for Heating and Cooling.** |
| ☐ | ☐ | Ceiling—minimum 6-inch mineral wool equivalent. |
| ☐ | ☐ | Walls—minimum 4-inch mineral wool equivalent. |
| ☐ | ☐ | Crawl space or unheated basement—minimum 2-inch mineral wool equivalent. |
| | | **Window Protection for Winter** |
| ☐ | ☐ | Install storm windows, or |
| ☐ | ☐ | Double or triple glazing, or |
| ☐ | ☐ | Cover windows with plastic. |
| | | **Utilize Winter Sun** |
| ☐ | ☐ | South and west window exposures are best for living areas. |
| | | **Protect House from Cold Winter Wind** |
| ☐ | ☐ | Plant, or build a windbreak landscape treatment. |
| ☐ | ☐ | Design house for maximum protection. |
| ☐ | ☐ | Protect entrances. |

| Have Done | Will Do | |
|---|---|---|
| | | **Seal Air Leaks** |
| ☐ | ☐ | Weatherstrip doors and windows. |
| ☐ | ☐ | Caulk cracks. |
| ☐ | ☐ | Seal unused doors. |
| | | **Protect House from Summer Sun** |
| ☐ | ☐ | Plant trees. |
| ☐ | ☐ | Install a roof overhang to protect windows. |
| ☐ | ☐ | Use awnings or other treatment. |
| | | **Utilize Breezes for Cooling During Warm Season** |
| ☐ | ☐ | Open windows in evening. |
| ☐ | ☐ | Close during mid-day. |
| | | **Temperature Control** |
| ☐ | ☐ | Reduce daytime home heating in winter, maintaining 68° F. or lower temperature. |
| ☐ | ☐ | Set air-conditioning unit to recirculate cool air instead of pulling in warmer outside air. |
| ☐ | ☐ | Increase temperature setting for summer air-conditioning, 78° F. or higher. |
| ☐ | ☐ | Reduce nighttime winter temperature 5°-8° or more. |

| Have Done | Will Do | |
|---|---|---|
| ☐ | ☐ | Use window and attic fans for cooling during summer when outside temperature is below house temperature. |
| ☐ | ☐ | Maintain heating and cooling equipment in good operating condition. |
| ☐ | ☐ | Keep air filters clean to make it easier for heating and cooling system to do its job. |
| ☐ | ☐ | Close off unused rooms and closets. |
| ☐ | ☐ | Use kitchen and bathroom exhaust fans only when necessary. |
| ☐ | ☐ | Install an exhaust fan in the attic to remove hot air in the summer. |
| ☐ | ☐ | Shade windows from direct sun in summer with draperies and roll-up shades. |
| ☐ | ☐ | Open draperies and roll up shades to receive sun's heat in winter. |
| ☐ | ☐ | Close door of attached garage in winter. |
| ☐ | ☐ | Close off flue when fireplace is not in use. |
| ☐ | ☐ | Select an energy efficient air-conditioning unit the proper size for space to be cooled. It is better to buy a slightly undersized unit, rather than an oversized one. |
| ☐ | ☐ | Repair leaks and insulate heating and cooling ducts in spaces not heated or cooled. |

| Have Done | Will Do | |
|---|---|---|
| ☐ | ☐ | Reduce heating and cooling temperatures when away from home for long periods of time. |
| | | **Lighting** |
| ☐ | ☐ | Turn off unnecessary lights, indoors and out. |
| ☐ | ☐ | Reduce lighting levels to minimum for task to be performed. |
| ☐ | ☐ | Use bulbs with lower wattage in halls, stairways, and other areas of general illumination. |
| ☐ | ☐ | Use light colors in decorating to improve lighting efficiency. |
| ☐ | ☐ | Do tasks which require a high light level during the daylight hours when possible. |
| ☐ | ☐ | Keep lighting fixtures clean. |
| ☐ | ☐ | Use fluorescent lighting for maximum light from electrical energy used. |
| ☐ | ☐ | Use timers to turn lights on in the evening rather than leaving lights on all day when no one is home. |
| | | **Heating Water** |
| ☐ | ☐ | Reduce the amount of hot water used. |
| ☐ | ☐ | Insulate long hot water pipes, especially those under the house or those that go through unheated basements. |

| Have Done | Will Do | |
|---|---|---|
| ☐ | ☐ | Repair leaky faucets. |
| ☐ | ☐ | Maintain regular temperature setting of 140 F. on water heater when hot water is needed. |

**Laundry**

| | | |
|---|---|---|
| ☐ | ☐ | Wash only full loads of laundry. |
| ☐ | ☐ | Use heated water in only the washing cycle. |
| ☐ | ☐ | Use water no hotter than necessary for adequate soil removal and sanitation. |
| ☐ | ☐ | Use good laundry techniques to obtain satisfactory results in one washing process. |
| ☐ | ☐ | Avoid over drying in the dryer. |
| ☐ | ☐ | Line dry garments and household items when practical. |
| ☐ | ☐ | Use the dryer efficiently. Avoid drying one or two items at one time. |
| ☐ | ☐ | Remove items when dryer stops to avoid unnecessary wrinkling, which will require pressing to remove. |
| ☐ | ☐ | Reduce ironing to a minimum by careful selection of garments and household linens. |

**Cleaning and Maintenance**

| | | |
|---|---|---|
| ☐ | ☐ | Empty or replace vacuum cleaner bag frequently to keep it functioning efficiently. |
| ☐ | ☐ | Eliminate unnecessary vacuuming and floor polishing. |
| ☐ | ☐ | Use hand equipment rather than power equipment when practical. |
| ☐ | ☐ | Develop preventative maintenance practices. Routine checkup and servicing will prevent greater problems later. |

**Cooking and Baking**

| | | |
|---|---|---|
| ☐ | ☐ | Use oven to capacity. |
| ☐ | ☐ | Use cooking utensils which fit the electric unit or gas burner. |
| ☐ | ☐ | Use tight-fitting lids on cooking utensils, when appropriate. |
| ☐ | ☐ | Reduce heat to maintain necessary cooking temperature when using surface units or burners. |
| ☐ | ☐ | Use small appliances for cooking, baking, and toasting if they are more efficient than the range. |
| ☐ | ☐ | Preheat oven only when necessary. Do not preheat longer than needed to attain required temperature. |
| ☐ | ☐ | Turn off oven, surface units, or burners promptly when food is cooked. |

**Refrigeration—Refrigerator and Freezer**

| | | |
|---|---|---|
| ☐ | ☐ | Avoid opening door or holding it open unnecessarily. |
| ☐ | ☐ | Keep grills and evaporator coils clean. |

| Have Done | Will Do | |
|---|---|---|
| ☐ | ☐ | Locate cooling appliances away from a heat source such as the range, hot air register, or direct sun. |
| ☐ | ☐ | Defrost as needed. |
| ☐ | ☐ | If cold air is leaking around door, have door adjusted or gasket replaced. |
| ☐ | ☐ | Turn off, empty, clean and leave refrigerator door open when taking an extended vacation. |
| ☐ | ☐ | Locate the refrigerator and freezer away from heat sources. |

**Dishwashing**

| | | |
|---|---|---|
| ☐ | ☐ | Accumulate dishes; hold until the dishwasher is filled. If dishes are hand washed, rinse and hold breakfast dishes until noon or evening. |
| ☐ | ☐ | Avoid wasting hot water by leaving it run continuously while washing or rinsing dishes. |

**Personal Care**

| | | |
|---|---|---|
| ☐ | ☐ | Minimize hot water used in bathing. Check to see if less water is used in showering than in tub bathing. |
| ☐ | ☐ | Do not leave water running while shaving, brushing teeth, etc. |
| ☐ | ☐ | Turn off faucets promptly after use. |

**Recreation and Entertainment**

| | | |
|---|---|---|
| ☐ | ☐ | Turn off TV, radio, or stereo when no one is really watching or listening. |
| ☐ | ☐ | Disconnect or use vacation setting on an instant-on TV when you are not going to be using it regularly. |
| ☐ | ☐ | Use shop or hobby equipment efficiently. |
| ☐ | ☐ | Maintain tools in good operating condition. |
| ☐ | ☐ | Encourage family members to develop leisure activities such as bicycling, hiking, reading, swimming, etc., that have low energy costs. |
| ☐ | ☐ | Spend vacations closer to home. |
| ☐ | ☐ | Encourage home and neighborhood activities. |

**The Family Automobile**

Drive at a moderate speed.

| | | |
|---|---|---|
| ☐ | ☐ | Drive smoothly with gradual starts and stops. |
| ☐ | ☐ | Don't warm up the car for more than a minute or two before driving. |
| ☐ | ☐ | Provide proper maintenance; make sure you have well-tuned engines and properly inflated tires. |
| ☐ | ☐ | Combine errands by careful planning. |
| ☐ | ☐ | Carpool whenever possible. |

**Other Transportation**

| | | |
|---|---|---|
| ☐ | ☐ | Walk, ride a bicycle, or use public transportation whenever possible. |
| ☐ | ☐ | Travel only when necessary. |

## Foreword

Your electric water heater is a large part of your total electric bill. But there is an economical way to reduce this cost. You see, the more insulation your electric water heater has, the less energy it uses, and the more money you save. Your water heater already has some insulation between the tank and outer metal cover. But it'll pay you to wrap another layer of insulation around it. The cash outlay is so little and the payback is so rapid, you'll recover your costs in a few months. After that, you'll enjoy lower hot water costs for the life of the appliance.

## Materials Needed:

1. 3½" R-11 blanket type
2. Duct tape
3. Scissors or knife
4. Tape measure

## Safety Precautions:

Don't cover the temperature pressure relief valve with insulation.

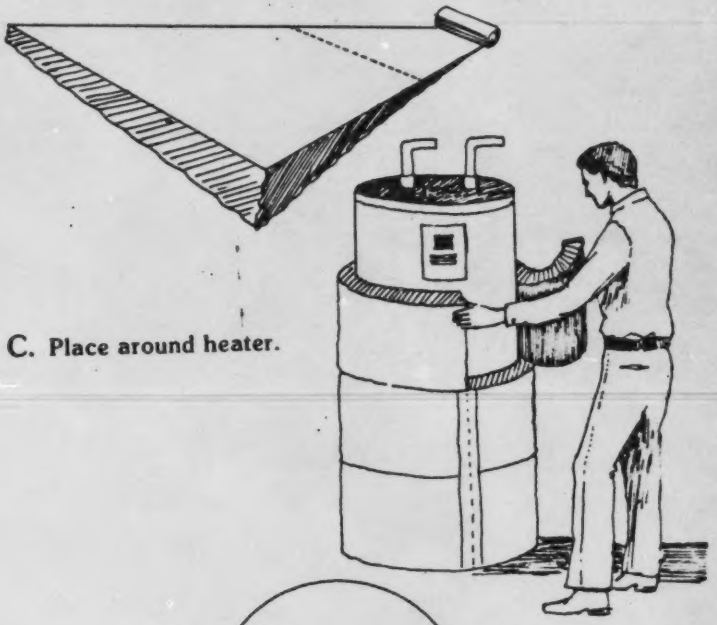
## Instructions:

1. Measure water heater's circumference (distance around) and height. Add 20 inches to the circumference measurement. (Fig. A)
2. Buy the amount of insulation needed. (Actually, you'll probably have to buy a roll and this will likely be far more than you need. So you might like to share a roll and its cost with a neighbor.)
3. Cut a sample piece. Be sure you've cut the correct length. It should go completely around the water heater without lapping or being compressed. Now cut enough pieces of this length to fully cover the unit, all around and from top to bottom. (Fig. B)
4. After cutting the required number of pieces, you're ready to put them around the water heater one at a time. (Fig. C)
5. With the paper or foil on the outside, stack one piece on top of the other and tape until the heater is enclosed. See cover photo.
6. Cut a round piece for the top. Cut as necessary to fit around pipes, then tape in place. (Fig. D)
7. To aid future service, mark location of access doors to the elements, drain valve, and electrical connections.

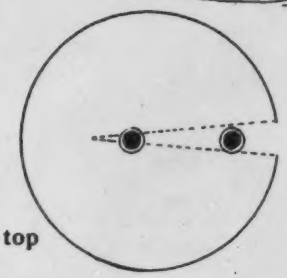
CAUTION: For safety reasons, **do not** apply the above instructions to a gas-fired water heater. Contact your gas company.

A. Measure

B. Cut a sample piece



C. Place around heater.

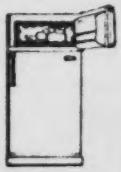
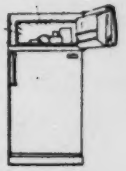
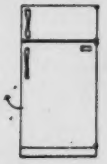
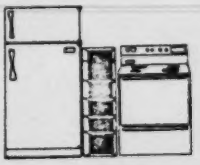
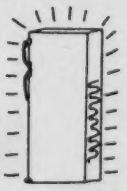
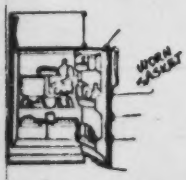
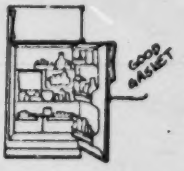


D. Cut piece for top

## Electric Water Heater Efficiency Use Notes:

1. Before insulating, check the thermostat setting. It shouldn't be above 150°.
2. Wait until you have a full load before running the automatic dishwasher or clothes washer.
3. Don't leave hot water running while handwashing dishes or shaving.
4. Use warm or cold water when possible for clothes washing, and always use cold water for rinsing.
5. Take short showers or shallow tub baths.

# When you have A REFRIGERATOR

| It Wastes your money when... | | It Saves your money when you... |
|---|---|---|
|  The frost gets too thick. | 1. |  Defrost when frost is 1/4 inch thick. |
| You keep the door open. | 2. |  Open and close the door quickly. |
| It is next to a stove, heater or in direct sunlight. | 3. |  Locate it away from heat. |
| The motor and coils get dusty. | 4. |  Keep motor and coils clean. |
| It is set too cold. | 5. | Set it to cool at about 40 degrees. (Set freezer at about zero.) |
|  The door gaskets are worn out. | 6. |  Replace or repair door gaskets. |

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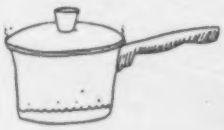
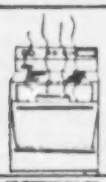
Use Electricity Wisely

# When you are COOKING FOOD

| It Wastes your money when you... | | It Saves your money when you... |
|---|---|---|
| Put a little pan on a big eye. | 1. | Fit the pan to the right size. eye. |
| Leave the eye on high. | 2. | Turn eye to low, after food steams. |
| Cook with lots of water. | 3. |  Cook with little water. |
| Cook food a long time. | 4. | Stop cooking when food is tender. |
| Cook one food in oven. | 5. | Cook many foods in oven at same time. |
| Leave lid off pan. | 6. | Put lid on pan. It keeps heat in. |
|  Peek in oven. | 7. | Keep oven door closed. Use clock to time food. |
| Toast bread in oven. | 8. | Toast bread in a toaster. |

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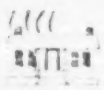
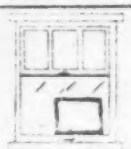
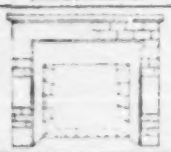
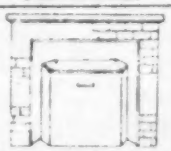
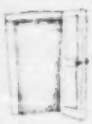
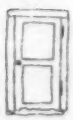
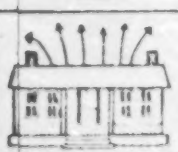
Use Electricity Wisely

# When You Are Trying To KEEP WARM

| It Wastes your money when you... | | It Saves your money when you... |
|---|---|---|
| Heat too much. Heat whole house. | 1. |  Heat only the room you're in. Keep heat low. Close off other rooms. |
| Wear thin clothes. | 2. | Wear warm clothes in several layers. |
| Have window up. | 3. | Keep windows closed. Cover them with plastic. |
| Have a broken window. | 4. |  Cover the hole. Use cardboard, paper, rags, or foil. Stop the cold air. |
|  Have open fireplace and chimney. | 5. |  Close fireplace and chimney. |
|  Leave door open. | 6. | Close outside doors quickly. |
| Have a crack under door. | 7. |  Stuff rags, paper, or a rug in crack under doors. |
| Use electric stove for heat. | 8. | Never use electric stove for heating. |
|  Have no insulation in your house. | 9. | Put insulation in ceiling. |

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Use Electricity Wisely

# When you are using HOT WATER

| It Wastes your money when you... | | It Saves your money when you... |
|---|---|---|
| Wash few clothes. | 1. | Wash full loads. |
| Wash with too much hot water. | 2. | Wash only very dirty clothes in hot water. |
| Fill bath tub full. | 3. | Fill only 1/4 full. |
| Wash dishes under running faucet. | 4. | Wash and rinse dishes in two pans. |
| Have a leaking faucet. | 5. | Fix the leaking faucet. |
| Have bare hot water pipes. | 6. | Wrap hot water pipes. |

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Use Electricity Wisely

PART THREE --

PREPARING FOR ENERGY CAREERS

# PROFESSIONAL ENERGY CAREERS

OBJECTIVES: The major objective of this unit of study is to make students aware of the professional careers available in the energy field and the educational requirements involved to enter such careers.

MATERIALS:

1. Booklet: Professional Energy Careers. The U.S. Department of Energy.
2. The General Catalog of the University of South Florida
3. Free sources of information found through Governmental and Social Services.
4. Mailing envelopes and postage stamps

PROCEDURE 1: Defining Energy Careers

Material: Booklet on Professional Energy Careers

A. Each student will be given the booklet on Professional Energy Careers.
B. A list of eight professional careers will be given the students by the teacher.
   1. Architect Engineer, pg. 4
   2. Chemical Engineer, pg. 6
   3. Computer Engineer, pg. 10
   4. Electrical Engineer, pg. 12
   5. Environmental Engineer, pg. 16
   6. Mechanical Engineer, pg. 32
   7. Petroleum Engineer, pg. 40
   8. Urban Planner, pg. 44
C. The students will use their bookelts to define each career.

PROCEDURE 2: Basic High School Requirements

Material: General Catalog of the University of Florida

A. The students will discuss their work from the previous day's lesson on defining the eight energy careers given them.
B. Each career will be broken down by the students with help from the teacher to determine educational requirements for each career. Educational requirements may include high school emphasis, college training, and possible adult education.

C. The students (with teacher supervision) will locate the educational requirements of the careers using the college catalog of the University of South Florida. High school requirements will be stressed by the teacher to make the student aware of academic requirements for admission into the fields desired.

1. Test Scores: S.A.T. & A.C.T.
2. High school mathematics
3. Mathematics preparation
4. Minimum grade average requirements

PROCEDURE 3: College Requirements

Material: Catalog of University of South Florida

A. Similarities of each curriculum core will be listed on the chalkboard by selected students to determine correlation between the various careers.
B. The 4 key elements required in college education for such engineering careers shall be listed and noted by the students. The 4 key elements are:
   1. A foundation in science and mathematics
   2. An understanding of major engineering disciplines
   3. A familiarity with social sciences and humanities
   4. Good communication skills
C. The basic education core for these careers will be given the students with emphasis on the 4 key elements instituted in the three education cores. The three education cores are:
   1. Social science and humanities core (communication skills) - 31 credit hours
   2. Mathematics and science core - 35 credit hours
   3. Engineering core - 38 credit hours

PROCEDURE 4: How To Use Sources of Information

Materials: Booklet on Professional Energy Careers
Mailing envelopes and postage stamps

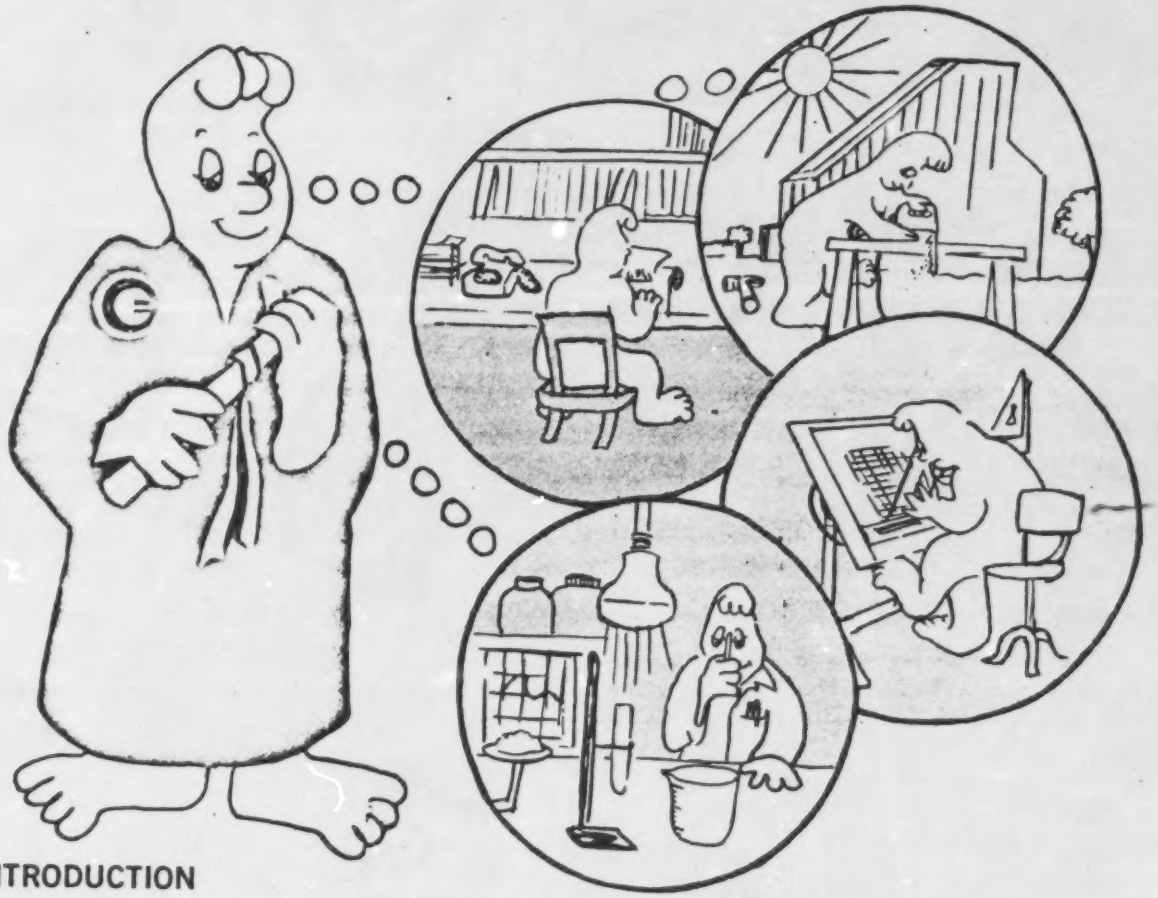
A. Each student will choose one of the eight professional careers for a further point of study to include lesson #5.
B. The students will use the "Sources of Information" to send off to those sources for further information on the particular careers. The teacher will aid the students in the mailing of these requests with teacher/school names and addresses.
C. The teacher will organize this task to make sure materials arrive at the school.
D. This lesson will teach the students the availibility of free information through governmental and social services, along with writing standards emphasized through their writing of request letters and the facing of envelopes.

PROCEDURE 5: Project on Sources of Information

Material: The free sources of information received through the mail on the particular careers.

A. After all sources of information have been received, the teacher will distribute the materials to each student according to the particular career they chose.
B. The students will be given one week to compile a Report/Bulletin Board on the information compiled by past lessons and the information ordered and received by the student from the teacher.

# CAREERS IN SOLAR ENERGY



## INTRODUCTION

Solar energy may well be a major energy source in the 21st century. Even now much experimental research in solar energy is being conducted, and solar construction and pilot projects are springing up worldwide. All are testing the possibility of solar energy as a future replacement for today's fossil fuel industries. New solar technology could revolutionize the energy field.

But what does this mean for future careers in the field of energy? What kinds of careers and jobs are available now, and what kinds might be in demand twenty years from now?

In this activity you will examine solar energy jobs and careers and the effect they could have on your own career choices.

## OBJECTIVES

At the completion of this activity you should be able to:

- o list possible jobs and careers in the solar energy field.
- o report the results of a literature search for information about solar energy jobs and careers.
- o determine the skills and education required for a particular solar energy job.
- o define and discuss technical terms relating to solar energy concepts.
- o explain the purpose of career education.

## SKILLS AND KNOWLEDGE YOU NEED

- How to do research in the library or media center using periodicals and reference materials.
- How to analyze words and terms for pronunciation and meaning.
- How to relate job skills to education skills.
- How to communicate with business personnel.

## MATERIALS

- A notebook in which to keep career information.
- The Reader's Guide to Periodical Literature.
- The employment sections of large circulation newspapers, such as The New York Times or The Philadelphia Enquirer.
- Periodicals (magazines).
- A word glossary.
- Manufacturers' lists.
- Career guidance library.

## METHOD

1. Discuss the concept of career education with your teacher and other members of your class. Then define the term.

2. Using The Reader's Guide to Periodical Literature, and recent magazines and news articles, conduct a literature search for articles and information on solar energy jobs and careers. Also use your career guidance library to obtain additional career information on this topic. Keep a "jobs and careers" notebook containing the information you have obtained, along with any articles or information which you were able to find.

3. Search the employment sections of various newspapers for advertisements relating to solar energy jobs and careers. If possible, cut these out and place them in your notebook.

4. Using the results of your literature search and the employment ads you found, develop a list in your notebook of jobs and careers in the solar energy field. For each, determine what the job is, and what educational levels and skills are required. Both the ad itself and your career guidance library will be helpful for this.

5. Listed below are some of the processes used in the solar energy industry. Working in a small group with 2 or 3 other class members, define the processes in your notebook. A word glossary may be helpful.

| | | |
|---|---|---|
| collection | circulation | design/construction |
| conversion | storage | development |
| transfer | distribution | experimentation |

6. Listed below are some of the materials and equipment used in the solar energy field. Working with your group again, explain in your notebook what each refers to.

| | | |
|---|---|---|
| collector | valves | furnace |
| system | metal ducts | heat exchanger |
| storage tank | piping | insulation |
| pump | gauges | |

7. Working with a partner, arrange to go out and interview someone working in the solar energy industry, such as a businessman or an installer of solar systems. Also interview representatives from state, federal, and local agencies who would be knowledgeable about jobs and careers in solar energy. Arrange for some class

members to interview the school guidance counselor for information on career possibilities in solar energy.

8. Working in a small group, develop a list of jobs and careers which will be affected by solar energy.

9. Working in a small group, develop a list of solar energy jobs and careers which may be in demand ten to twenty years from now. (This will require some creative thinking.)

## LOOKING BACK

By now, you should have a good idea of the job and career possibilities in the field of solar energy. You have found that job and career opportunities are most easily discovered through a search of magazines and newspapers, as well as through direct contact with businessmen, industry representatives and your guidance counselor. Have you found a job or career which might interest you?

## QUESTIONS

1. How many different jobs and careers did you list in your notebook?

2. Make a list of solar energy jobs which require each of the following educational levels:

   a. No high school diploma required.
   b. High school diploma.
   c. 2 years of college or vocational training.
   d. 4 years of college.
   e. Advanced degree (Master's or Ph.D.)

3. Where are the best places to look for solar energy job and career opportunities?

4. Are there any new, unusual, or interesting job opportunties in solar energy? If so, what are they?

## GOING FURTHER

- Make a list of satellite (indirect) jobs which will be affected by the solar energy industry.

- Keep an updated list over a period of time of new careers and jobs in solar energy.

Teacher Information Sheet

# CAREERS IN SOLAR ENERGY

## Suggested Grade Level and Discipline

7-12 Science

## Background Information

Career education is striving to provide an active relationship between the academic world and the world in which people earn a living. Most high school students do not have adequate knowledge of the career opportunties open to them, especially when there are tens of thousands of job titles in the United States, and especially when the number of these job titles increases almost too rapidly to keep track of them. Consideration of the job opportunities in a new and rapidly expanding field, such as solar technology, should help to bridge the gap.

The United States Office of Education has developed the cluster concept, which groups job titles in the following categories:

- Construction
- Manufacturing
- Agribusiness and Natural Resources
- Marine Science
- Environment
- Business and Office
- Consumer and Homemaking
- Marketing and Distribution
- Communications and Media
- Hospitality and Recreation
- Personal Service
- Public Service
- Health Opportunities
- Fine Arts and Humanities

## Hints on Gathering Materials

- Information regarding solar energy careers can be obtained from the use of the references listed at the end of this Teacher Information Sheet. Additional information may also be obtained by contacting solar organizations and manufacturers.
- Announce ahead of time that a notebook will be required for this activity.
- It would be advisable to let your guidance counselors know ahead of time that this activity is planned so that they can be prepared.
- Your guidance department may subscribe to the computerized Guidance Information System (GIS). If so, this will make occupation information easily available through the nearest computer terminal.

## Suggested Time Allotment

- This will vary depending on the depth of coverage you desire for this topic, and upon how many of the activities you assign to your class. Assignment of most of the activities would require 1 to 2 weeks for completion.



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Suggested Approach

- A thorough introduction to the basic concepts and principles of solar energy technology is needed before this activity will be successful. It is suggested that this activity be used near the end of a unit or set of activities on solar energy, so that students already possess basic knowledge of solar energy concepts.

- Students should be given a basic orientation to the concept of career education before this activity is attempted.

- Activities which require student creativity and independent thought should be encouraged to help maintain interest.

- Having students work together in small groups will also help to maintain interest and enthusiasm as well as to increase their total output. A brief introduction to the purposes of "brainstorming" may help activities 9 and 10 to be more successful.

Typical Results

- Some of the jobs and careers in solar energy which students will "discover" are listed below:

Insulation Installer
Auxiliary System Installer
Sheet Metal Worker
Fabrication Worker
Prefabrication Worker
Architect
Lawyer
Salesperson
Real Estate Broker
Appraisor
Assessor
Zoning Agent
Consumer Protection Agent
Home Construction Laborer
Standards Developer
Scientist
Insurance Agent
Investor
System Installer
Dealers
Builders
Maintenance Person
Repair Person
Bill Collector
Inspector

Carpenter
Mason
Electrician
Plumber
Air Conditioning Person
Heating Person
Cooling Person
Refrigeration Person
Glazier
Factory Worker
Crane Operator
Roofer
Pipe Fitter
Contractor
Legislator
Consultant
Engineer
Designer
Developer
Banker
Estimator
Researcher
Furnace Person
Trainer - Educator
Licenser

Precautions

- *Be sure to allow enough time for students to complete some of the longer-range activities such as the literature search.*

Modifications

- Depending on the desired depth of coverage, different numbers of activities may be assigned from the METHOD section, varying from only a few activities to most of the activities assigned.

- You may wish to ask a guidance counselor to address your class as a whole, rather than having individual students seek them out. The same might apply to business people and representatives from the solar energy industry.

Evaluation

- Answers to questions can be collected and evaluated for completeness for the extent to which the student researched the activity. Notebooks can be evaluated on the basis of extent of research. Lists of job and careers can be evaluated for understanding of career opportunties. Student involvement in the small groups can be evaluated for extent of participation. Interview results can be evaluated for depth of questioning and for understanding of solar concepts and job opportunities.

References


- *Careers in Energy Industries.* (Department of Energy, Washington, D.C.) (Pamphlet - FEA/A - 75/228)

- *Energy Sources and Careers*, (Billerica, Massachusetts: Megatech Corp.) (Booklet/transparencies) 1978

- *School Subjects and Jobs.* (Chicago: Science Research Associates, Inc.) 1971

- *Solar Energy: Potential Powerhouse for Jobs*, Work Life, August 1976 (Reprinted in Social Issues Resources Series, *Energy*, Vol. 2 - #33.)

- *The Dawn of an Industry*, Nation's Business, The Chamber of Commerce of the U.S., September 1974. (Reprinted in Social Issues Resources Series, *Energy*, Vol. 1, Article #79)

TITLE: Career Awareness and Exploration

CONCEPT: Awareness and Exploration of self in relationship to energy/conservation careers. In-depth study for students leaving school is suggested.

OBJECTIVES: To help students describe employment prospects for major occupational groups and industrial sectors.

To help students explore emerging and promising career fields in engineering and science.

To help students analyze their aptitudes, and then match their aptitudes to job characteristics.

To help students analyze and develop an effective strategy for identifying jobs with good prospects, and, for landing the job of their choice.

NOTE: The following knowledge base for this lesson is based on the Eli Ginsberg Theory of Career Development - the 3 stages - Fantasy, Tentative, Realistic.

KNOWLEDGE BASE: Helping students make career choices starts with a good understanding of job hunting skills. A student must make a realistic decision concerning his/her career. As small children up to approximately age eleven, the student was in the fantasy stage of believing that he/she could be any type worker he/she desired. After the fantasy stage, the student progressed into a tentative stage of thinking about his/her career future. During the tentative stage, the student realizes that career choices msut be narrowed down and the fantasy stage becomes more remote.

Tentative stage thinking involves ages of approximately eleven to about fourteen/fifteen years of age. (Since each individual develops at their own pace, the years given above represent an approximation of maturation in career thinking.) After exploration in the tentative stage, most students enter the realistic stage where they recognize that a choice must be made.

Activity 1: Using the facilities available in the guidance office area, have each student research at least one occupation of their interest related to energy career fields. It is suggested that the student use Florida View (Vital Information for Education and Work) developed by the Florida Center for Career Development Services. In each high school, there shall be a set of microfiche and a hard copy of each page of the microfiche located in the career guidance center, career information center or library. Encourage students to also use the Occupational Outlook Handbook, Encyclopedia of Career, occupational monographs or briefs, pamphlets, and/or talk directly with a person doing the specific job the student has shown interest in. Within the realm of the research, have each student write the basics of the occupation (e.g., training required, personal characteristics, economic returns, working conditions, job duties, etc.) and how the occupation is directly or indirectly energy related. Have each student prepare both a written report of their research and and outline of this report.

Activity 2: Invite a guest speaker from the Florida State Employment Service or Personnel Director of a large energy concern to speak to the class on employment. Ask the speaker to be direct and responsive to student questions as to employer expectations, employment outlook and future training/and retraining. Have students formulate a series of group or individual questions prior to date speaker(s) will be in classroom.

Activitiy 3: Simulate job interviews. A vital step in developing job hunting skills and in the job search process in the interview. Discuss with the students the two types of interviews direct and indirect which are used by personnel directors, etc. Set up a schedule of interviews for the students. Interview the student for the occupation he/she has chosen to research and write a resume. You may wish to select volunteers from the community, fellow teachers, yourself, etc., to aid in the simulated interviews. If this situation is to be in front of the class, you may wish to have each student critique the simulated job interview for each student. Observation often sharpens job skill of interviewing.
OPTIONAL: VTR for student being interviewed to review and critique his/her own pros/cons of the interview.

# National Energy Information Sources

**Alliance to Save Energy (ASE)**
**1925 K Street, N.W.**
**Suite 507**
**Washington, D.C. 20006**
**202/857-0666**

ASE is a nonprofit public interest organization. The Alliance provides consumers with easy, effective methods of saving energy, and works to establish local citizen committees to promote energy conservation. Individuals contributing to the Alliance receive a monthly newsletter on energy conservation.

**American Gas Association (AGA)**
**1515 Wilson Boulevard**
**Arlington, VA 22209**
**703/841-8400**

AGA is an organization of 6,000 individuals and companies involved in gas production, distribution, transportation or other gas-related endeavors. AGA's Consumer Information Service provides information on the production, distribution, consumption, research and safety of natural, manufactured and mixed gases.

**American Nuclear Society (ANS)**
**555 North Kensington Avenue**
**LaGrange Park, IL 60525**
**312/352-6611**

The ANS has a membership base of 12,000 physicists, chemists, educators, engineers, mathematicians, metallurgists and life scientists. The ANS offers publications answering questions concerning nuclear energy.

**American Petroleum Institute**
**2101 L Street, N.W.**
**Washington, D.C. 20037**
**202/457-7000**

API represents over 7,000 petroleum producers, refiners, marketers and transporters. API provides publications and information on any petroleum topic, including exploration, production, refining, marketing, transportation, research, and product protection and safety.

**Americans for Energy Independence (AEI)**
**1629 K Street, N.W.**
**Suite 1201**
**Washington, D.C. 20006**
**202/466-2105**

AEI is a nonprofit public interest organization. Contributors to AEI receive a quarterly newsletter, pamphlets on energy topics, and book discounts.

**Atomic Industrial Forum (AIF)**
**7101 Wisconsin Avenue**
**Washington, D.C. 20014**
**301/654-9260**

AIF is comprised of industrial firms, research organizations, educational institutions, labor groups and government agencies engaged in development and utilization of nuclear energy for constructive purposes. The AIF can provide materials on all aspects of nuclear power generation.

**Edison Electric Institute (EEI)**
**1111 19th Street, N.W.**
**Washington, D.C. 20036**
**202/828-7400**

EEI, the association of investor-owned electric companies, provides information on virtually every topic concerning electrical energy. A variety of materials, including pamphlets and films are available. Inquiries should be addressed to EEI's Department of Public Relations.

**Electric Power Research Institute (EPRI)**
**P.O. Box 10412**
**Palo Alto, CA 94303**
**415/855-2000**

EPRI is funded by more than 500 electric utilities. The Institute issues publications about current research and development . . . including solar, coal, geothermal, fusion, environmental, nuclear and fossil fuel generation projects.

**Food and Energy Council**
**909 University Avenue**
**Columbia, MO 65201**
**314/442-5517**

The Council is comprised of electric power suppliers, equipment manufacturers and agricultural interests. It distributes materials about the direct relationship between adequate supplies of food and energy.

**National Coal Association (NCA)**
**1130 17th Street, N.W.**
**Washington, D.C. 20036**
**202/628-4322**

NCA is an association of coal producers, sellers, equipment suppliers and transporters. NCA offers publications on coal production, distribution, usage and research.

**National Council for Environmental Balance (NCEB)**
**P.O. Box 7732**
**Louisville, KY 40207**
**502/896-8731**

NCEB is a nonprofit educational organization. Members are educators and researchers in engineering or scientific disciplines. NCEB offers nontechnical books and pamphlets on developing and preserving the environment, through scientific knowledge, while providing for man's physical and social needs. Titles of publications available on request.

**National Electrical Manufacturers Association (NEMA)**
**2101 L Street, N.W.**
**Washington, D.C. 20037**
**202/457-8400**

NEMA represents over 550 manufacturers of equipment used in machines, lighting equipment and other products utilizing electricity. NEMA produces an audit handbook for conserving energy in commercial and retail establishments (cost $1). Through its in-house National Lighting Bureau, NEMA provides information on efficient sources of lighting.

**$SE_2$ (Scientists and Engineers for Secure Energy, Inc.)**
**1225 Nineteenth Street, NW**
**Suite 415**
**Washington, D.C. 20036**
**202/223-5381**

$SE_2$ is a national, non-profit organization of some 1,000 scholars, scientists and engineers. $SE_2$ is dedicated to bridging the gap between the professional scientific community and decision makers by providing accurate and timely scientific and technical information relating to the sensible development of energy and natural resources and to the protection of the environment. The membership, which includes seven Nobel Laureates, represents a broad and bipartisan body of expertise in energy and energy-related fields and seeks to help the public, press and governments through consulting, public statements, meetings, workshops, studies and testimony.

**United States Department of Energy (DOE)**
**Office of Public Affairs**
**1000 Independence Ave., S.W.**
**Washington, D.C. 20585**
**202/252-5568**

Publications about all energy sources and information on how to conserve energy may be obtained by writing or calling the DOE.

# PROSPECTS & OPPORTUNITIES 3

## Where You Will Work:

-Major oil companies or small independent oil exploration and production companies.
-Companies that produce drilling equipment and supplies.
-For Banks and other financial institutions which need their knowledge of the economic value of oil and gas properties.

## Job Outlook:

-With efforts to attain energy self-sufficiency and with high petroleum prices, the demand for Petroleum Engineers will increase greatly.

## Job Advancement:

-Most advancement in the engineering field comes with salary increases.

-Training beyond the bachelor's degree is also another way to advance.

## Related Occupations:

-Engineers, all fields
-Petroleum Technologists
-Geologists

## For More Information:

-Society of Petroleum Engineers of AIME
6200 North Central Expressway
Dallas, Texas 75206





# PREPARATION & TRAINING

## EDUCATION REQUIRED:

| High School | College or Technical Training: |
|---|---|
| 10 11 12 | 1 2 3 4 or more |

1. Some engineering courses are 5 years in length.
2. Helpful high school courses include chemistry, physics, math, calculus, geology, and drafting.
3. To teach in universities or do research, training beyond the bachelor's degree is required.

## More Facts:

Since there is no real demand for Petroleum Engineers in Florida, no training sites in this state have been identified. Here is a list of public universities outside Florida that offer a degree in Petroleum Engineering:

University of Alabama
Mississippi State University
Louisiana State University
University of Southwestern Louisiana
Louisiana Technical University
Texas A&M
University of Texas at Austin
University of Tulsa

FLORIDA CENTER FOR CAREER DEVELOPMENT SERVICES
Department of Education
Knott Bldg Tallahassee, Florida 32301 904 488-0400

JOB TITLE: PETROLEUM ENGINEER
OCC#: 409
DOT#: 010.061-018
SOC#: 1625-208
REVISED DATE: August, 1982
This information valid until: August, 1983

# THE JOB

The Petroleum Engineer studies and advises on problems in exploring and drilling for oil and gas.

## Job Duties:

1. The Engineer plans, organizes and supervises the extraction of petroleum and natural gas.
2. Studies geological surveys and advises on types of derrick and drilling equipment to be used.
3. Computes and maps the slope of holes to be drilled.
4. Plans the method of drilling. Recommends and supervises the use of drilling mud and casing cement, and directs special techniques to solve drilling problems.
5. Investigates and tests new drilling equipment.
6. Directs testing of boreholes to determine pressures, temperatures, and other factors.
7. Devises methods of bringing wells into production and controlling flow of oil or gas.
8. Recommends procedures for treating oil to remove dirt and water.
9. Determines oil-gas ratios of producing wells, and designates the proper flow to meet regulations.

## Working Conditions:

-Much time is spent at a desk drawing and planning, however, in this particular field of engineering a lot of time is spent outdoors on the drilling site.

## Hours of Work:

-Normal work week. Overtime may be necessary if a well does something unexpected.

## Usual Fringe Benefits:

Can include paid vacations, holidays, sick leave, hospitalization, retirement plans.





# MATCHING THIS JOB TO YOU

## Job Characteristics:

**Personal Interests**

You must like to:
-Deal with things, numbers, and objects
-Do analytical, scientific or technical work
-Do abstract and creative work
-Work with machines, equipment or processes

**Scholastic Aptitudes**

Required: A Bachelor's Degree in engineering is required for beginning engineering jobs.
You should:
-Pay close attention to detail
-Work independently and take responsibility
-Make sure your work meets strict standards

**Physical Traits**

You must be able to:
-Reach, handle, finger,
-Speak clearly
-Hear well
-See differences between colors and textures
-Lift and carry up to 25

## You Should Know That:

-Many engineers obtain master's degrees for promotion purposes.
-There is some risk of bodily injury involved.
-Many Petroleum Engineers go into the research and development area.

## Economic Returns:

| | |
|---|---|
| Earnings Range: | $13,500 - $32,500/year and above for Ph.D.'s |
| Most Workers Earn | $17,250 - $26,500/year |
| Usual Starting Salary | $13,500 - $16,500/year |

## Things to Think About:

-Almost three-fourths of all Petroleum Engineers are employed in the oil producing States of Texas, Oklahoma, Louisiana, and California.
-Many American engineers work overseas in oil-producing countries.
-Pay is good.

# FLORIDA TRAINING SITES 5

**NOTE: The Solid Dots have Training for this Occupation.**

## Area Vocational Technical Centers:

| | | | | |
|---|---|---|---|---|
| ● | 1. Atlantic Vocational Technical Center | 4700 Coconut Creek Parkway | Coconut Creek 33066 | 305/975-6230 |
| ● | 2. Bay Area Vo Tech Center | 1370 Lewis Turner Blvd. | Ft. Walton Beach 32548 | 904/862-9147 |
| ● | 3. Bradford Union Area Voc Tech Center | 609 N. Orange Street | Starke 32091 | 904/964-6138 |
| ● | 4. Charlotte Vocational Technical Center | 1668 Toledo Blade | Port Charlotte 33953 | 813/629-6819 |
| ● | 5. Collier County Vocational Technical Center | 5702 Lotey Avenue | Naples 33963 | 813/775-5855 |
| ● | 6. Erwin Vocational Technical Center | 2010 East Hillsborough | Tampa 33610 | 813/971-5631 |
| ● | 7. Thomas P. Haney Vo Tech | 3018 Highway 77 | Panama City 32405 | 904/785-3181 |
| ● | 8. Lake County Area Vocational-Technical Ctr | 2001 Kurt Street | Eustis 32726 | 904/357-4252 |
| ● | 9. Lee County Voc Tech Center | 3800 Michigan Avenue | Fort Myers 33905 | 813/334-4544 |
| ● | 10. Lindsey Hopkins Educational Center | 1410 N.E. Second Avenue | Miami 33132 | 305/350-3254 |
| ● | 11. Lorin M. Lively Area Voc Tech Center | 830 N. Appleyard Drive | Tallahassee 32304 | 904/576-3161 |
| ● | 12. Ralford M. Lastinger Area Voc Tech Center | 3210 Berryhill Road | Milton 32570 | 904/626-1918 |
| ● | 13. Manatee Area Vocational Technical Center | 5603 34th Street, West | Bradenton 32507 | 813/755-1841 |
| ● | 14. Miami Lakes Technical Educational Center | 5780 N.W. 158th Street | Miami Lakes 33014 | 305/557-1100 |
| ● | 15. The Florida Technical Institute | 2900 W. Oak Ridge Road | Orlando 32809 | 305/855-5600 |
| ● | 16. Mirror Lake Tomlinson Adult Vocational Ctr | 709 Mirror Lake Drive | St. Petersburg 33701 | 813/821-4583 |
| ● | 17. Robert Morgan Vocational Technical Center | 18180 S.W. 122nd Avenue | Miami 33177 | 305/253-9920 |
| ● | 18. Ronto Technical Education Center | 7071 Garden Road | Riviera Beach 33404 | 305/848-0634 |
| ● | 19. Orlando Vocational Technical Center | 301 W. Amelia Street | Orlando 32801 | 305/425-2756 |
| ● | 20. Pinellas Vocational Technical Institute | 6100 154th Avenue North | Clearwater 33520 | 813/531-3521 |
| ● | 21. Polk County Area Vocational Technical Ctr | P.O. Box 720 | Eaton Park 33840 | 813/665-1229 |
| ● | 22. Ridge Vocational Technical Center | 7700 State Road 544 | Winter Haven 33880 | 813/422-6403 |
| ● | 23. St. Augustine Technical Center | Collins Ave at Del Monte Dr. | St. Augustine 32084 | 904/824-4401 |
| ● | 24. St. Petersburg Voc Tech Institute | 901 34th Street South | St. Petersburg 33711 | 813/327-3671 |
| ● | 25. Sarasota County Voc Tech Center | 4748 Bonora Road | Sarasota 33581 | 813/924-1305 |
| ● | 26. Sheridan Vocational Technical Center | 5400 Sheridan Street | Hollywood 33021 | 305/983-8651 |
| ● | 27. South Technical Education Center | 1300 S.W. 30th Avenue | Boynton Beach 33435 | 305/271-0284 |
| ● | 28. George Stone Area Voc Tech Center | Route 10 Box 530 | Pensacola 32506 | 904/944-1414 |
| ● | 29. Suwannee Hamilton Area Voc Tech Center | 415 S.W. Pinewood Drive | Live Oak 32060 | 904/362-2252 |
| ● | 30. Tampa Bay Voc Tech Center | 6410 Orient Road | Tampa 33610 | 813/621-2441 |
| ● | 31. Taylor County Area Voc Tech Center | 3233 Highway 19 South | Perry 32347 | 904/584-7683 |
| ● | 32. Washington Holmes Area Voc Tech Center | 328 Hoyt Street | Chipley 32428 | 904/638-1180 |
| ● | 33. Webster Adult Education Center | 901 Webster Avenue | Winter Park 32789 | 305/647-6768 |
| ● | 34. Westside Vocational Technical Center | 731 E. Story Road | Winter Garden 32787 | 305/656-2851 |
| ● | 35. Wm. Turnbull Education Center | 3825 State Road 715 | Belle Glade 33430 | 305/996-4358 |
| ● | 36. Withlacoochee Area Voc Tech Center | 1607 W. Main Street | Inverness 32650 | 904/726-2430 |

## Community Colleges:

| | | | | |
|---|---|---|---|---|
| ● | 50. Brevard Community College | 1519 Clearlake Road | Cocoa 32922 | 305/632-1111 |
| ● | 51. Broward Community College | 225 E. Las Olas Blvd. | Ft. Lauderdale 33301 | 305/761-7463 |
| ● | 52. Central Florida Community College | P. O. Box 1388 | Ocala 32670 | 904/237-2111 |
| ● | 53. Chipola Junior College | College Street | Marianna 32446 | 904/526-2761 |
| ● | 54. Daytona Beach Community College | P. O. Box 1111 | Daytona Beach 32015 | 904/253-4131 |
| ● | 55. Edison Community College | College Parkway | Fort Myers 33907 | 813/489-9318 |
| ● | 56. Florida Jr. College at Jacksonville | 21 West Church Street | Jacksonville 32202 | 904/358-1812 |
| ● | 57. Florida Keys Community College | One Junior College Road | Key West 33040 | 305/296-9081 |
| ● | 58. Gulf Coast Community College | 5230 W. Highway 98 | Panama City 32401 | 904/769-1551 |
| ● | 59. Hillsborough Community College | P. O. Box 22127 | Tampa 33622 | 813/879-7222 |
| ● | 60. Indian River Community College | 3209 Virginia Avenue | Fort Pierce 33454 | 305/464-2000 |
| ● | 61. Lake City Community College | Route 7 Box 42 | Lake City 32055 | 904/752-1822 |
| ● | 62. Lake Sumter Community College | 5900 U.S. 441 South | Leesburg 32748 | 904/787-3747 |
| ● | 63. Manatee Junior College | P. O. Box 1849 | Bradenton 33508 | 813/755-1511 |
| ● | 64. Miami Dade Community College | 11011 S.W. 104th Street | Miami 33176 | 305/596-1345 |
| ● | 65. North Florida Junior College | Turner Davis Drive | Madison 32340 | 904/973-2288 |
| ● | 66. Okaloosa Walton Junior College | 100 College Blvd. | Niceville 32578 | 904/678-5111 |
| ● | 67. Palm Beach Junior College | 4200 Congress Avenue | Lake Worth 33461 | 305/439-8100 |
| ● | 68. Pasco Hernando Community College | 2401 S. Highway 41 North | Dade City 33525 | 904/567-6701 |
| ● | 69. Pensacola Junior College | 1000 College Blvd. | Pensacola 32504 | 904/476-5410 |
| ● | 70. Polk Community College | 999 Avenue H Northeast | Winter Haven 33880 | 813/294-7791 |
| ● | 71. St. Johns River Community College | 5001 St. Johns Avenue | Palatka 32077 | 904/328-1519 |
| ● | 72. St. Petersburg Junior College | P.O. Box 13489 | St. Petersburg 33733 | 813/546-0021 |
| ● | 73. Seminole Community College | P.O. Box 1505 | Sanford 32771 | 904/377-5161 |
| ● | 74. Santa Fe Community College | | Gainesville 32602 | 904/377-5161 |
| ● | 75. Santa Fe Community College | | Sanford 32771 | 305/323-1450 |
| ● | 76. South Florida Junior College | 600 W. College Drive | Avon Park 33825 | 813/453-6661 |
| ● | 77. Tallahassee Community College | 444 Appleyard Drive | Tallahassee 32301 8178 | 904/576-5161 |
| ● | 78. Valencia Community College | P.O. Box 3028 | Orlando 32802 | 305/296-5060 |





# FLORIDA TRAINING SITES CONT. 6

## Public Universities:

| | | | | |
|---|---|---|---|---|
| ● | 79. Florida A&M University | Martin Luther King Jr. Blvd. | Tallahassee 32307 | 904/599-3796 |
| ● | 80. Florida Atlantic University | | Boca Raton 33431 | 305/393-3040 |
| ● | 81. Florida International University | Tamiami Trail | Miami 33199 | 305/552-1000 |
| ● | 82. Florida State University | | Tallahassee 32306 | 904/644-6200 |
| ● | 83. University of Central Florida | | Orlando 32816 | 904/282-1565 |
| ● | 84. University of Florida | | Gainesville 32611 | 904/392-1365 |
| ● | 85. University of North Florida | 4567 St. Johns Bluff Rd. South | Jacksonville 32216 | 904/646-2624 |
| ● | 86. University of South Florida | 4202 Fowler Avenue | Tampa 33620 | 813/974-2250 |
| ● | 87. University of West Florida | | Pensacola 32504 | 904/474-2428 |

## Private Education and Other Training Sites:

**Need help locating a job in this career field? Ask your occupational specialist or guidance counselor about CAPS-Cooperative Agency Placement System.**

FLORIDA CENTER FOR CAREER DEVELOPMENT SERVICES
Department of Education
Knott Bldg Tallahassee, Florida 32301 904/488-0400

JOB TITLE: POWER PLANT OPERATOR
OCC#: 433
DOT#: 952.382.018
SOC#: 6932-244
REVISED DATE: July, 1982
This information valid until: August, 1983

# THE JOB

1

The Power Plant Operator runs boilers, turbines, generators and other electrical generating equipment at a power plant.

## Job Duties:

1. Watches the control boards and adjusts switches, using instruments.
2. Adjusts water, blower and firing systems to start or to control boilers.
3. Adjusts controls to get steam to the correct temperature and pressure for the turbines.
4. Adjusts controls of turbines to match voltage and phases of electricity being generated.
5. Watches newly started generators to already working generators.
6. Watches gauges to see the effect of a generator on other equipment.
7. Keeps records of electrical supply and demand and of breakdowns, repairs and maintenance of machinery.

## Working Conditions:

-Works mainly inside.
-Noise, dust and grease will be present.

## Hours of Work:

-Usually 40 hours per week.
-Some overtime may be necessary.

## Usual Fringe Benefits:

-Can include life & health insurance, sick & vacation time, overtime pay, retirement, etc.





# MATCHING THIS JOB TO YOU

## Job Characteristics:

**Personal Interests**

-Dependable
-Able to work alone
-Able to follow instructions
-Mechanically inclined
-Work inside all day
-Take a certain amount of risk
-Figure out how things work

**Scholastic Aptitudes**

High school diploma or equivalent.
Recommended courses are: English, Math, Physical Science, Physics, Drafting, and Wood and Metal Shops

**Physical Traits**

-Good health
-Normal vision and hearing
-Above average hand-finger dexterity
-Good color discrimination

## You Should Know That:

-This is an apprenticeable career in Florida.
-Union membership may be expected.
-You will be expected to maintain and do temporary repairs on your equipment.
-You may have to work at night or on weekends.
-Job dangers include falls, cuts, burns and severe electrical shock.

## Economic Returns:

| | |
|---|---|
| Earnings Range | $4.00 - $9.30/hour |
| Most Workers Earn | $6.50 - $8.50/hour |
| Usual starting Salary | $4.00 - $4.65/hour or 50% of Journeyman's wage. |

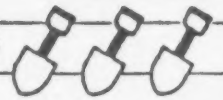
Please Note...Not all employers are required to pay the Federal Minimum Wage. For specific information about employers in your area contact your local office of the U.S. Department of Labor, Wage and Hour Division. Your counselor or occupational specialist can help. Or, write us and we'll send this information to you.

## Things to Think About:

You must be able to:

-Read about and use electrical and mechanical instruments.
-Perform tasks requiring physical strength.
-Work in crawling, standing, or climbing positions.
-Use many kinds of hand tools.
-Work at dangerous heights.
-Solve problems without the help of formal plans or aids from other people.

# PROSPECTS & OPPORTUNITIES 3



## Where You Will Work:

Power Plant Operators work for public and private utility companies.

## Job Outlook:

Apprentices are hired by industry only when they have a need for more skilled workers. Since the Florida Apprenticeship programs have been designed to fill an employer need, a fully trained apprentice (or journeyman) should have little trouble being employed at a good wage.

## Job Advancement:

1. The experienced, highly trained Power Plant Operator may rise to Supervisor or Plant Foreman.

## Related Occupations:

-Air Conditioning Mechanic
-Aircraft Lay-Out Worker
-Electronic Assembler
-Data Processing Equipment Technician
-Diesel Mechanic
-Electrical Repairer
-Instrument Repairer
-Maintenance Mechanic
-Millwright
-Office Machine Repairer
-Plumber

## For More Information:

Ask your Guidance Counselor or Occupational Specialist for the address of the nearest area office of the Bureau of Apprenticeships or contact the central office at:

Florida Bureau of Apprenticeships
1321 Executive Center Drive, East
Tallahassee, Florida 32301
(904) 488-0232





# PREPARATION & TRAINING 4

## EDUCATION REQUIRED:

| High School | College or Technical Training: |
|---|---|
| 10 11 12 | 1 2 3xxxxtrxxAfterx |

Apprenticeship is a way of learning the skills needed to become a career worker in industry while earning a good wage. Registered apprenticeship programs in Florida are developed to give both on-the-job experience and classroom instruction. These programs usually take from three to five years to finish.

IF YOU WANT TO BECOME A REGISTERED APPRENTICE, YOU MUST:

1. Be 18 or over.
2. Have a high school diploma or equivalent.
3. Talk to your representative of the Florida Bureau of Apprenticeship.
4. Be physically able to do the work of the trade.
5. Be recommended by a selection committee.
6. Pass a job aptitude test.

## More Facts:

This Apprenticeship Program is available on military bases in Florida. For information, contact your representative of the United States Bureau of Apprenticeship and Training.

-You may have to buy your own tools and protective clothing.
-You must go to at least 144 hours of job-related classroom instruction per year.

# FLORIDA TRAINING SITES 5

**NOTE: The Solid Dots have Training for this Occupation.**

## Area Vocational Technical Centers:

| | | | | | |
|---|---|---|---|---|---|
| ○ | 1. | Atlantic Vocational Technical Center | 4700 Coconut Creek Parkway | Coconut Creek 33066 | 305/975-8230 |
| ○ | 2. | Bay Area Vo Tech Center | 1976 Lewis Turner Blvd. | Ft. Walton Beach 32548 | 904/862-0187 |
| ○ | 3. | Bradford Union Area Voc Tech Center | 800 N. Orange Street | Starke 32091 | 904/964-6150 |
| ○ | 4. | Charlotte Vocational Technical Center | 1468 Toledo Blade | Port Charlotte 33952 | 813/629-6819 |
| ○ | 5. | Collier County Vocational-Technical Center | 2705 Exley Avenue | Naples 33963 | 813/774-6838 |
| ○ | 6. | Erwin Vocational Technical Center | 1010 East Hillsborough | Tampa 33610 | 813/238-0031 |
| ○ | 7. | Thomas P. Haney Voc Tech | 3010 Highway 77 | Panama City 32405 | 904/769-2191 |
| ○ | 8. | Lake County Area Vocational-Technical Ctr | 2001 Kurt Street | Eustis 32726 | 904/357-9228 |
| ○ | 9. | Lee County Voc Tech Center | 3800 Michigan Avenue | Fort Myers 33905 | 813/334-4544 |
| ○ | 10. | Lindsey Hopkins Educational Center | 1410 N.E. Second Avenue | Miami 33132 | 305/350-3254 |
| ○ | 11. | Lewis M. Lively Area Voc-Tech Center | 500 N. Appleyard Drive | Tallahassee 32304 | 904/575-3181 |
| ○ | 12. | Rachael M. Lastinger Voc Tech Center | 5319 Berryhill Road | Milton 32570 | 904/626-1810 |
| ○ | 13. | Manatee Area Vocational-Technical Center | 5603 34th Street, West | Bradenton 33507 | 813/755-1961 |
| ○ | 14. | Miami Lakes Technical Educational Center | 5780 N.W. 158th Street | Miami Lakes 33014 | 305.557.1100 |
| ○ | 15. | Mid Florida Technical Institute | 2900 W. Oak Ridge Road | Orlando 32809 | 305.855-5850 |
| ○ | 16. | Mirror Lake Tomlinson Adult Vocational Ctr | 909 Mirror Lake Drive | St. Petersburg 33701 | 813.821-4593 |
| ○ | 17. | Robert Morgan Vocational Technical Center | 18180 S.W. 122nd Avenue | Miami 33177 | 305.253-9920 |
| ○ | 18. | North Technical Education Center | 7071 Gordon Road | Riviera Beach 33404 | 305.848-0694 |
| ○ | 19. | Orlando Vocational Technical Center | 301 W. Amelia Street | Orlando 32801 | 305.425-3758 |
| ○ | 20. | Pinellas Vocational Technical Institute | 6100 154th Avenue North | Clearwater 33520 | 813/531-3331 |
| ○ | 21. | Polk County Area Vocational Technical Ctr | P.O. Box 720 | Eaton Park 33840 | 813/683-1220 |
| ○ | 22. | Ridge Vocational Technical Center | 7700 State Road 544 | Winter Haven 33880 | 813.422.6405 |
| ○ | 23. | St. Augustine Technical Center | Collins Ave at Del Monte Dr. | St. Augustine 32084 | 904.824-4481 |
| ○ | 24. | St. Petersburg Voc Tech Institute | 901 34th Street South | St. Petersburg 33711 | 813.327.3671 |
| ○ | 25. | Sarasota County Voc Tech Center | 4748 Beneva Road | Sarasota 33581 | 813.924.1365 |
| ○ | 26. | Sheridan Vocational Technical Center | 5400 Sheridan Street | Hollywood 33021 | 305.963-6653 |
| ○ | 27. | South Technical Education Center | 1300 S.W. 30th Avenue | Boynton Beach 33435 | 305.278-0364 |
| ○ | 28. | George Stone Area Voc Tech Center | Route 10, Box 530 | Pensacola 32506 | 904.944-1426 |
| ○ | 29. | Suwannee-Hamilton Area Voc Tech Center | 415 S.W. Pinewood Drive | Live Oak 32060 | 904/362 2252 |
| ○ | 30. | Tampa Bay Voc Tech Center | 4810 Orient Road | Tampa 33610 | 813.621 2441 |
| ○ | 31. | Taylor County Area Voc Tech Center | 5233 Highway 19, South | Perry 32347 | 904.584-7565 |
| ○ | 32. | Washington-Holmes Area Voc Tech Center | 209 Hoyt Street | Chipley 32428 | 904.638-1180 |
| ○ | 33. | Webster Adult Education Center | 901 Webster Avenue | Winter Park 32789 | 305.647-8366 |
| ○ | 34. | Westside Vocational Technical Center | 721 E. Story Road | Winter Garden 32787 | 305.656-2851 |
| ○ | 35. | West Technical Education Center | 2825 State Road 715 | Belle Glade 33430 | 305.996-4950 |
| ○ | 36. | Withlacoochee Area Voc Tech Center | 1467 W. Main Street | Inverness 32650 | 904.726-2430 |

## Community Colleges:

| | | | | | |
|---|---|---|---|---|---|
| ○ | 38. | Broward Community College | 1519 Cleartake Road | Cocoa 32922 | 305.632 1111 |
| ○ | 39. | Broward Community College | 225 E. Las Olas Blvd. | Ft. Lauderdale 33301 | 305.761 7469 |
| ○ | 40. | Central Florida Community College | P. O. Box 1388 | Ocala 32670 | 904/237 2111 |
| ○ | 41. | Chipola Junior College | College Street | Marianna 32446 | 904/526 2761 |
| ○ | 42. | Daytona Beach Community College | P. O. Box 1111 | Daytona Beach 32015 | 904.253 8131 |
| ○ | 43. | Edison Community College | College Parkway | Fort Myers 33907 | 813.489-9310 |
| ○ | 44. | Florida Jr. College at Jacksonville | 21 West Church Street | Jacksonville 32202 | 904.358 1812 |
| ○ | 45. | Florida Keys Community College | One Junior College Road | Key West 33040 | 305.296-9081 |
| ○ | 46. | Gulf Coast Community College | 5230 W. Highway 98 | Panama City 32401 | 904.769-1551 |
| ○ | 47. | Hillsborough Community College | P. O. Box 22127 | Tampa 33622 | 813.879-7222 |
| ○ | 48. | Indian River Community College | 3209 Virginia Avenue | Fort Pierce 33454 | 305.464 2000 |
| ○ | 49. | Lake City Community College | Route 7, Box 62 | Lake City 32055 | 904.752 1822 |
| ○ | 50. | Lake Sumter Community College | 9908 U.S. 441 South | Leesburg 32748 | 904 787 3747 |
| ○ | 51. | Manatee Junior College | P. O. Box 1849 | Bradenton 33506 | 813.755-1511 |
| ○ | 52. | Miami Dade Community College | 11011 S.W. 104th Street | Miami 33176 | 305.596-1365 |
| ○ | 53. | North Florida Junior College | Turner Davis Drive | Madison 32340 | 904.973 2288 |
| ○ | 54. | Okaloosa Walton Junior College | 100 College Blvd. | Niceville 32578 | 904 678 5111 |
| ○ | 55. | Palm Beach Junior College | 4200 Congress Avenue | Lake Worth 33461 | 305.439 8100 |
| ○ | 56. | Pasco Hernando Community College | 2401 S. Highway 41 North | Dade City 33525 | 904 567 6701 |
| ● | 57. | Pensacola Junior College | 1000 College Blvd. | Pensacola 32504 | 904.476-5410 |
| ○ | 58. | Polk Community College | 999 Avenue H, Northeast | Winter Haven 33880 | 813 294 7771 |
| ○ | 59. | St. Johns River Community College | 3001 St Johns Avenue | Palatka 32077 | 904 328-1519 |
| ○ | 60. | St. Petersburg Junior College | P. O. Box 13489 | St. Petersburg 33733 | 813 546-0021 |
| ○ | 61. | Santa Fe Community College | P. O. Box 1530 | Gainesville 32602 | 904 377 5161 |
| ○ | 62. | Seminole Community College | | Sanford 32771 | 305 323 1450 |
| ○ | 63. | South Florida Junior College | 600 W. College Drive | Avon Park 33825 | 813 453 6661 |
| ○ | 64. | Tallahassee Community College | 444 Appleyard Drive | Tallahassee 32301 8198 | 904 576 5181 |
| ○ | 65. | Valencia Community College | P. O. Box 3028 | Orlando 32802 | 305 299 5000 |





# FLORIDA TRAINING SITES CONT. 6

## Public Universities:

| | | | | | |
|---|---|---|---|---|---|
| ○ | 78. | Florida A&M University | Martin Luther King Jr. Blvd. | Tallahassee 32307 | 904.599-3798 |
| ○ | 79. | Florida Atlantic University | | Boca Raton 33431 | 305.393-3040 |
| ○ | 80. | Florida International University | Tamiami Trail | Miami 33199 | 305.552 2020 |
| ○ | 81. | Florida State University | | Tallahassee 32306 | 904.644-6200 |
| ○ | 82. | University of Central Florida | | Orlando 32816 | 904.275 2163 |
| ○ | 83. | University of Florida | | Gainesville 32611 | 904.392 1365 |
| ○ | 84. | University of North Florida | 4567 St. Johns Bluff Rd., South | Jacksonville 32216 | 904.646-2634 |
| ○ | 85. | University of South Florida | 4202 Fowler Avenue | Tampa 33620 | 813.974-3350 |
| ○ | 86. | University of West Florida | | Pensacola 32504 | 904.474-2400 |

## Private Education and Other Training Sites:

**Need help locating a job in this career field? Ask your occupational specialist or guidance counselor about CAPS-Cooperative Agency Placement System.**

PART FOUR --

ENERGY FOR ENGLISH CLASSES -
WRITING ABOUT ENERGY THEMES
AND EXPERIENCES

Teacher Information Sheet

# SOLAR ENERGY IN A MAGAZINE

## Suggested Grade Level and Discipline

7-12 Science
(Actually can be used with almost any discipline.)

## Background Information

This country is facing a possible energy crisis in the near future. The costs of energy sources are continuously rising as their supply is decreasing. The natural gas shortage in the winter of 1977 led many people to realize that we must begin to search for alternate energy sources. One of these sources is solar energy.

It is very important that all citizens be made aware of all the possible energy sources. This education can begin in the schools. Therefore, in this activity, students are going to make optimum use of the library facilities in order to determine what alternatives we have in the energy field. They will especially concentrate on solar energy. Since most information on solar energy is of a recent nature, students will be directed to make particular use of magazine articles and pamphlets.

## Hints on Gathering Materials

- Prior to this activity (if it requires budgetary allotments this could be as far as a year in advance) the teacher should:

  a. Check the availability of magazines such as Popular Science, Popular Mechanics, U.S. News and World Report, etc.

  b. Coordinate with the librarian the use of facilities, microfilm readers, etc., perhaps having the librarian review library procedures.

## Suggested Time Allotment

- This can vary from 2 days to 1 week.

## Suggested Approach

- This activity can be used as an introduction to a unit on solar energy.
- Check the student's ability to use various library resources such as the card catalogue and Reader's Guide to Periodical Literature. If any students are deficient in these skills have the librarian give them adequate instruction.

- Students should work individually.

- Students should begin to list on their data sheets the sources of information on solar energy.

- The students are then to check whether the magazine or source listed is available in their library. If not, they should try to determine where they may find it.

- The student should read the article or source material and make notes as to its content, its readability, etc. (Some articles may be too technical or too difficult for this particular class.)

- Check library resources prior to this assignment. Many articles may be listed but few actually available.

- Students should be checked on the use of micro-film by the librarian prior to using equipment.

- Insure that there are enough Readers' Guides for the number of students using them.

Typical Results

- Depending on the source material available, the student will have an extensive bibliography as a supplement for his solar energy work.

Precautions

- *None*

Modifications

- This activity may be used to extend into alternate energy sources, e.g., wind, water, geothermal.

- This accivity may be used as preparation for writing a research paper.

Evaluation

- Check the students' answers to the questions and also check their data sheet.

# SOLAR ENERGY IN A MAGAZINE

## INTRODUCTION

With the need for alternate energy sources becoming more noticeable and desirable every day, an obvious source is the sun. What needs do we have as far as energy is concerned? How can solar energy fit these needs? What research and development has been done in the area of solar energy? Most of the recent work is too new to be found in textbooks but is instead found in various magazine articles. In this activity you will be using your library to find some of this information.



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## OBJECTIVES

This research should enable you to:

- o find and list the available sources of information regarding solar energy.
- o see what has been done in the area of solar energy research and development.

## SKILLS AND KNOWLEDGE YOU NEED

- How to use the library resources, especially the Reader's Guide to Periodical Literature.

## MATERIALS

- Library resources.

## METHOD

1. From the Reader's Guide or other library references, find and list the articles or books concerning the energy crisis, sources of energy, and solar energy. Use one or more of the data sheets to record this information.
2. Using your list, find as many of these articles as possible. Read five of them and note the important parts on a separate sheet of paper. While doing this keep in mind that the material could be used for general discussion by all the class. If a source is not available, also note this on your data sheet.

## LOOKING BACK

The information you have collected will serve as a reference to you, your class and your teacher in studying solar energy. It will also serve as a bibliography for your own research of solar energy. The sources which you could list, yet not find in your library, may be available in other libraries such as county, regional or even state libraries.

## QUESTIONS

1. Which magazine or reference do you think contains the best article on solar energy?
2. Were there any magazines or references that were too difficult for you to read?
3. Based on your research, how important is solar energy as a future energy source?

## GOING FURTHER

- Write a research paper on some aspect of solar energy.
- Try to obtain additional information on solar energy from such sources as the government, utilities, industries, or businesses.
- Try to obtain some of the sources not available in your library.

LIBRARY RESOURCE LIST DATA SHEET

| TITLE OF THE ARTICLE OR REFERENCE | AUTHOR IF INDICATED | MAGAZINE OR OTHER REFERENCES | VOL./ISSUE | DATE | PAGES | WHERE AVAILABLE |
|---|---|---|---|---|---|---|
| | | | | | | |

DEVELOPING PARAGRAPHS - JUNIOR HIGH

OVERVIEW: This unit should follow lessons on the structure of a paragraph. After the students have mastered the topic sentence, they are then ready for these series of lessons. Also incorporated into this unit is a study of energy and energy sources. These lessons should also be taught in conjunction with the science classes.

I. Lesson I: Developing a paragraph using facts

A. OBJECTIVES:

The student will be able to:

1. Plan a paragraph before writing one to organize his thoughts
2. Write down supporting details to develop a topic sentence
3. Express knowledge gained on field trips and science discussions in writing activities
4. Develop a paragraph from their plans using facts

B. TIME ALLOTMENT: 45 minutes

C. PROCEDURES:

1. Pre-Writing Activities (20 minutes)

a. The students will have already visited Wauchula Power Plant to observe the production of electricity and Kaplan Industries to see the process of making methane gas.

They should have teken notes on their observations and class discussions.

b. The students will be given a model paragraph that has been developed with facts.

c. The students will choose the topic sentence and list all the details that support it.

d. The teacher will go over this activity on the board with the students explaining how a paragraph is developed.

e. The student will write a plan by choosing one of the following topic sentences and jotting down facts to support it.

f. To assist them in getting started and to help them give clear and specific details, questions have been added after each topic sentence.

*Wauchula Power Plant, operating since 1937, is the main source of energy for Wauchula (How does it run?) (When does it run?) (How many units are operative?) (How much does it cost to operate?)

*Kaplan Industries makes use of every part of the cow. (How do they use manure?) (What is the methane gas used for?) (What do they do with the bones?)

*At American Orange every part of the orange is used. (What happens to the pulp after the orange is used to make concentrate?) (What are the pulp and seeds used for?)

2. Writing (25 minutes)

a. The students will write a paragraph using their plans as a guide.

b. The students will turn these paragraphs in to the teacher.

3. Post Writing

a. The teacher will grade the paper and make grammatical corrections.

b. The teacher will make suggestions for improvements.

c. The students will rewrite the paragraphs, and the students will be expected to keep them in their writing notebooks to be graded by the English and science teachers at the end of the unit.

D. MATERIALS:

1. Notes from field trips and science class discussions
2. Hand-out of paragraph development and exercise with topic sentences
3. Chalkboard
4. Students' notebooks
5. Textbook, Warriner's English Grammar, c. 1977.

II. Lesson II. Developing a paragraph using reasons

A. OBJECTIVES:

The student will be able to:

1. Develop a plan and paragraph using reasons or opinions
2. The students will look at alternative energy sources for future use
3. Develop their opinions for the best energy sources after research

B. TIME ALLOTMENT: 45 minutes

C. PROCEDURES:

1. Pre-Writing Assignments (20 minutes)

   a. The students will be given the handout, "A Chart of Alternative Energy Sources."

   b. The students will be given a copy of Solar Energy in Florida - pg C-1.

   c. The students will be given a model paragraph that has been developed with reasons.

   d. The teacher will have the students choose the topic sentence and list the reasons given to support it.

   e. The teacher will go over the paragraph with the students and give them time to look at handouts.

2. Writing (25 minutes)

   a. The students will write a plan and develop it into a paragraph using reasons as supporting details.

   b. The students may choose one of the following:

      1) The only hope for our future is solar energy.

      2) Solar Energy is reasonable and cost efficient.

      3) They may choose one of the alternative energy sources and write their own topic sentence with the teacher's guidance.

4) Nuclear energy is our only hope for the future.

5) Nuclear energy is safe and efficient.

3. Post Writing Activities

a. The teacher will make corrections and suggestions.

b. The students will rewrite the paragraphs and keep them in notebooks for their English and science teachers.

D. MATERIALS:

1. Handout on Model Paragraph and topic sentences

2. Chalkboard

3. "A Chart of Alternative Energy Sources" reprinted with permission of The Curious Naturalist, Vol. XIV, #8, c. 1975.

4. Solar '80's, pg. C-1, C-2, David E. LaHart, March, 1980.

5. Notes from science class

6. Students" notebooks

III. Lesson III. Developing a paragraph using examples

A. OBJECTIVES:

The student will

1. Develop a plan and paragraph using examples

2. Look at the alternative sources for future use

3. Develop opinions about the alternative sources and choose the most practical

B. TIME ALLOTMENT: 45 minutes

C. PROCEDURES:

i. Pre-Writing Activities (20 minutes)

a. The teacher will discuss the paragraphs with the students from the previous day.

b. The teacher will have the students get out chart for alternative energy sources to review.

c. The teacher will go over model paragraph for developing a paragraph using examples.

2. Writing (20 minutes)

a. The students will write a plan and paragraph using examples.

b. The students may choose one of the following topic sentences:

1) There are several efficient and practical energy sources available today.

2) All energy sources have limitations.

3) All energy sources have advantages.

4) Alternative sources of energy such as solar, wind, fission, and geothermal must be considered for development to meet long term energy needs of people.

5) or choose 4 alternatives that the student thinks is most efficient and explain why they are acceptable.

3. Post Writing

a. The students will turn paragraphs in to be graded, corrected, and critized.

b. The teacher will give the papers back to the students to rewrite and keep in notebooks.

D. MATERIALS:

1. Model paragraph for examples and handout for choices of topic sentence.

2. Science notes

3. Handout "Chart of Alternative Energy Sources" re-printed with permission of The Curious Naturalist, Vol. XIV, #8, C. 1975.

4. Chalkboard

5. Students' notebooks

6. Textbook

IV. Lesson IV. Developing paragraph using comparison and contrast

A. OBJECTIVES:

1. The student will write a paragraph using comparisons or contrast.

2. The student will review the alternative energy sources to compare and contrast them.

3. The student will learn how to do an interview.

4. The student will learn about energy sources in his grandparents' day.

B. TIME ALLOTMENT: 45 minutes
2 days

C. PROCEDURES:

1. Pre-Writing (15 minutes)

a. The student will be given a model paragraph developed by comparisons and contrast.

b. The teacher will help the students point out topic sentence and supporting details.

c. The students will review the chart for energy alternatives to look for comparisons and contracts.

2. Writing (20 minutes)

   a. The student will write a plan and paragraph using comparisons and/or contrasts.

   b. Students may choose one of the following:

      1) Unlike nuclear, solar energy has universal appeal.

      2) Unlike petroleum, the price and availability of solar energy are not subject to manipulations by other nations.

      3) Choose 2 or 3 of the alternative energy sources and compare them and/or contrast them.

3. Post Writing Activities (10 minutes)

   a. The students will turn in papers to be checked by teacher.

   b. The students will rewrite paragraphs making corrections.

   c. The students will keep papers in notebooks.

   d. The students will be given the ditto, "The Good Ole Days?" and be asked to interview someone who is old enough to remember what life was like before the days of the great usage of oil and natural gas. This should be accomplished by the next day.

4. Day 2

   a. The student will write a plan and paragraph using the interview to compare and contrast our day to the day of the person interviewed.

   b. The students will be asked to share the interview with the class.

   c. The teacher will collect the paragraphs and interviews.

   d. The paragraphs will be given back to be rewritten.

D. MATERIALS:

1. Model paragraph using comparisons and choices for topic sentence.

2. "The Good Ole Days," Activity Master 8, The Energy Challenge.

3. Chart for Alternative Energy Sources.

4. Chalkboard

5. Students' notes and notebooks

6. Textbook.

V. Lesson 5. Explaining a process

A. OBJECTIVES:

1. The student will write a paragraph explaining a process.

2. The student will arrange in order the steps of the process at Kaplan Industries.

B. TIME ALLOTMENT: 45 minutes

C. PROCEDURES:

1. Pre-Writing Activities (15 minutes)

a. The teacher will give a model of writing a paragraph explaining a process.

b. The teacher will go over model paragraph on chalkboard.

c. The student will put in order the steps of the process at Kaplan Industries.

2. Writing (30 minutes)

a. The students will list these steps in order:

cattle in pens
the force of gravity
boiler
recipe for food
holding tank
power plant
solid end product
compression liquid
slits in pen floor
scrapers
methane

b. The students will write a topic sentence and paragraph explaining this process.

c. The students will hand paragraph in to be checked by teacher.

D. MATERIALS:

1. Notes of Kaplan Industries
2. Ditto on steps at Kaplan Industries
3. Model paragraph explaining a process
4. Chalkboard
5. Textbook

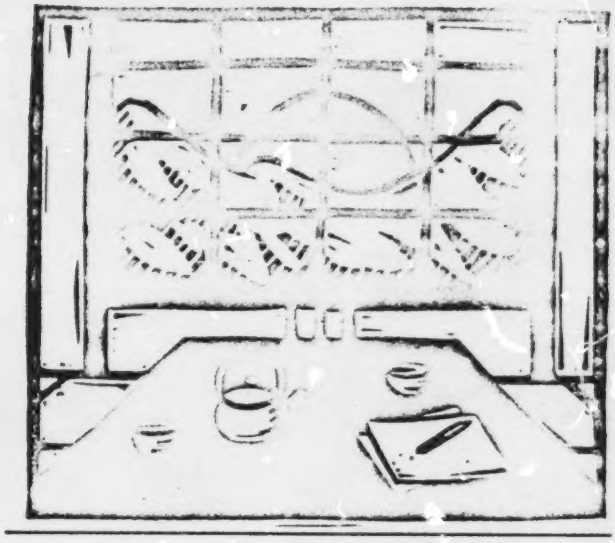
VI. EVALUATION:

A. The English teacher will give an overall grade for rewritten paragraphs grading most on structure, grammatical sentence, usage, and spelling.

B. The Science teacher will grade the students on content and quality.

C. The student will be encouraged to write a thank you letter to Kaplan, American Orange, and Wauchula Power Plant.

D. An overall test on the paragraph will be given.



PART FIVE ---

TOURING A POWER GENERATING PLANT

To tour the Wauchula Power Plant, contact Mr. Warren May or Mr. Tom Priest.

To tour the Florida Power Corporation facility in Avon Park, contact Mr. Robert Hoffman, Plant Manager.

TITLE: Welcome to the Power Plant

CONCEPT: Awareness of a potential job area, and an awareness of a vast plant and its value to the population and the environment.

OBJECTIVES: Students will become aware of the career opportunities and careers that the power plants offer.

Students will become aware of how electricity travels through a transmission system.

Students should be able to describe the importance of energy efficient equipment.

Activity 1: Arrange on on-site tour for students through power plant's public relations officer. (Suggested to make arrangement 30 days in advance.) Have students prepare a series of questions prior to field-trip:

a. Questions regarding plant operation/output

b. Careers available on-site.

Activity 2: After tour discuss power plant operation and output.

Activity 3: Have students create a sketch of plant site and the process of making electricity.

Activity 4: Discuss with students the aspect of conservation being a "form of energy."

Activity 5: Have students list careers observed at plant site. Formulate a master list from class response. (Previous to this activity, establish contact with plant personnel director and obtain a listing of job titles of workers on site.) Suggest to students to select one career observed or known to exist at plant site that was of interest to report on. Students may use Florida V.I.E.W. Career Development Services System, or other available publications concerning worker facts such as Dictionary of Occupational Titles. Have each student compare him/herself to the career selected and write a report on the findings of worker facts and his/her facts.

PART SIX --

EXPLORATORY VOCATIONAL
LESSONS IN ENERGY

ENERGY FROM THE SUN

OBJECTIVE: Students will recognize the basic technology of solar collection, of possible solar systems for heating or cooling buildings. This is a five-part lesson plan.

PROCEDURE:

1. The teacher will present the following information:

   The sun is the "mother star" of our solar system. the sun's energy is thermonuclear in origin. The sun's core is so hot, that a nuclear reaction takes place releasing tremendous amounts of energy into space in the form of rays on waves of radiation.

2. Guided Practice:

   Teacher will demonstrate the rays of visible light waves by shining a beam of sunlight through a prism or even drinking glass full of water.

3. Checking for Understanding:

   Teacher will orally question students:

   a. What is the Mother Star?
   b. What is thermonuclear energy?
   c. What takes place in the sun's core?
   d. Where the rays pass through the prism, does this change colors?

4. Independent Practice:

   Students will fill out handout sheets and make corrections.

5. Summary:

   Teacher will go over system again.

6. Evaluation will be based on students' performance.

SOLAR ENERGY: HEATING WATER

OBJECTIVE: Students will learn the advantages and disadvantages of solar energy in heating water.

PROCEDURE:

1. Presentation of Information

   Teacher will discuss the following:

   a. Expensive to install
   b. The sun doesn't always shine
   c. Would mean modification of building in many cases
   d. New laws would be needed concerning construction that might cast shadows.

ADVANTAGES:

1. Supply: The sun's energy is almost inexhaustable.
2. Pollution: Solar energy is clean, no mining or burning.
3. Embargoes: No nation can cut off another nation's supply of sunlight.
4. Cost: Installation is inexpensive to maintain.

2. Checking for Understanding

   Teacher will orally question students about advantages and disadvantages.

3. Summary:

   Teacher will recap all points, expenses, laws, sun did not shine, modification.

SOLAR HOT WATER HEATERS

OBJECTIVE: Introduce students to taking advantage of the sun's energy to heat water.

PROCEDURE:

1. Presentation of Information

   Teacher will explain that to operate solar collectors, the collector should be placed on the southside of the house, how solar heat is obtained on a cloudy day, you must use a back up system. Teacher will explain to students that no part of the U. S. would be able to use solar heat wit9out a conventional back-up furnace. What kind of fluid can be used in a solar energy system? Air or water? Electricity can be generated from solar collector fields.

2. Guided Practice:

   Teacher will hand out sheet Part 1 "Energy from the Sun."

3. Checking for Understanding:

   Teacher will use teachers worksheet "Energy from the Sun" Part 1 to go over questions 1 through 6 with the class.

4. Summary:

   Teacher will recap worksheets and blackboard work.

5. Independent Practice:

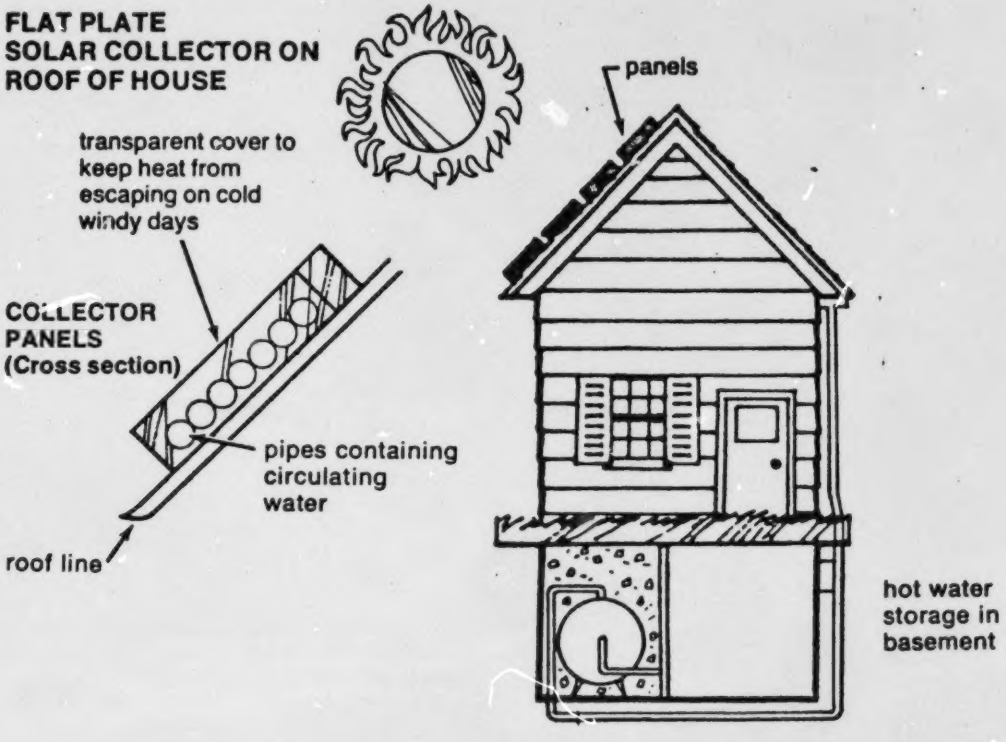
   Students will be broken down into groups, teacher will demonstrate with students by using different colored quart jars and thermometers the principle of heating water.

6. Evaluation will be based on daily work.

Activity Master 12

# *Energy from the Sun* (Part 1)

There are several ways to use solar (sun) energy. The simplest way is to design a building to take advantage of its natural environment, including the sun. Another way is for each house, apartment or office building to collect enough solar energy to take care of its own heating, air conditioning, and water heating, but not its electric power. A third way is to set up a huge collecting field to collect solar energy, turn it into heat in a power tower, and then to electricity that will be sent to individual dwellings. A one-square mile field of many of these collectors could supply electricity for about 20,000 houses.


FLAT PLATE SOLAR COLLECTOR ON ROOF OF HOUSE
panels
transparent cover to keep heat from escaping on cold windy days
COLLECTOR PANELS (Cross section)
pipes containing circulating water
roof line
hot water storage in basement

1. What direction should the collectors face for the greatest amount of sun?
south

2. How is solar heat obtained at night or on a cloudy day? from storage system until empty; then from a conventional back up furnace

3. What parts of the U.S. would be able to use solar heat without a conventional back-up furnace?
none

4. What kind of fluid can be used in a solar energy system?
air or water

5. How can someone decide whether or not to install a solar energy system in their home? by comparing cost of system with savings in cost of conventional fuel.

6. Could the heat from a solar collector field be used to generate electricity?
yes

SOLAR HEATING SYSTEMS MAY HEAT HOUSES

OBJECTIVE: Have students have an understanding of how a solar heating system works for heating a home.

PROCEDURE:

1. Presentation of Information

   Teacher will draw on an overhead projector the solar energy house on the blackboard.

2. Guided Practice

   Teacher will pass out handout sheets and students will fill in sheets as teacher explains the route of energy on the blackboard.

3. Checking for Understanding

   Students will be asked the following questions:

   a. Why is it necessary to have a back-up system?
   b. Where is the solar collector panels located?
   c. How does the hot water flow?
   d. How does the hot water flow to the house?

4. Summary

   Teacher will recap the sun's energy; what takes place in the core of the sun.

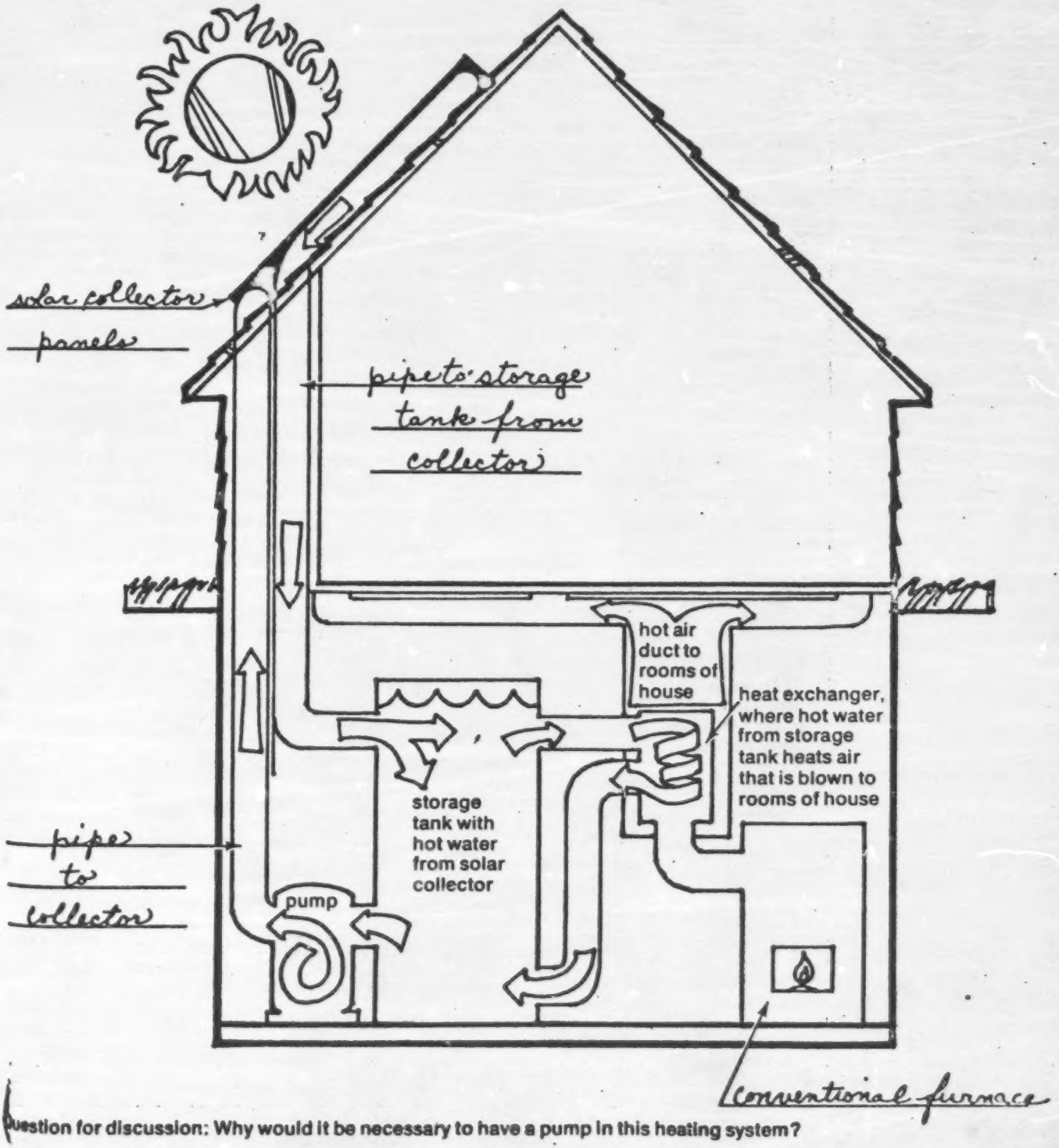
5. Students will be broken into groups and under teacher's guidance will experiment with different amount of water in glass

# *Energy from the Sun* (Part 2)



The diagram below shows how a solar heating system might heat a house. In this case you see a system that uses the energy of the sun to heat water that runs through collectors on the roof of the house. Because there can be many days when the sun doesn't shine, even a solar-heated house needs a conventional furnace. The conventional furnace runs when the storage tank runs short of hot water from the collector.

See if you can label the parts of the solar heating system below. Use these words: **solar collector panels, pipe to storage tank from collector, pipe to collector, conventional furnace.** Write the correct words on the lines.


solar collector panels
pipe to storage tank from collector
hot air duct to rooms of house
heat exchanger, where hot water from storage tank heats air that is blown to rooms of house
storage tank with hot water from solar collector
pipe to collector
pump
conventional furnace

**Question for discussion: Why would it be necessary to have a pump in this heating system?**

SOLAR CELLS

OBJECTIVE: Students will have an understanding of solar cells and why they are.

PROCEDURE:

1. Presentation of Information

   A solar cell is a device that converts sunlight directly into electricity, with no moving parts and no pollution.

   a. Solar cell systems are now used to power spaceships.

   b. We probably will noever run out of silicone as a resource because it is the second most plentiful substance on earth.

   c. Now it costs $20 a watt to generate electricity by means of solar cells.

2. Guided Practice

   Teacher will pass out worksheets and go over them with students.

3. Checking for Understanding

   Questions:

   a. Who is now using solar cells?
   b. Do you know a more common name for silicones?
   c. How much would it cost to power a 100 watt light bulb by using solar cells?
   d. What do we need to do before we can use solar cells as an energy source?
   e. How can electricity be stored to use later?

4. Summary

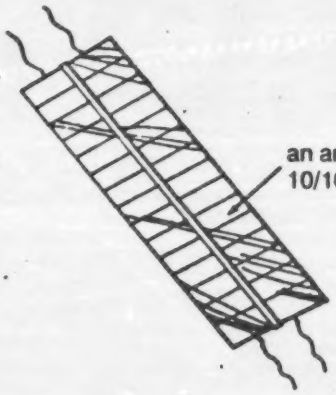
   Teacher will recap with students the questions and answers; discuss worksheet and point out to students the correct answers.

Activity Master 14

# *Energy from the Sun* (Part 3)

## SOLAR CELL

This device converts sunlight directly into electricity, with no moving parts and no pollution.


an array of thin silicone cells 10/1000 in. thick
wires lead to electrical batteries which power lights and motor-driven appliances.

1. Solar cell systems are now used to power spaceships and military outposts far from other sources of electricity; and satellites

2. We probably will never run out of silicone as a resource because it is the second most plentiful substance on earth. Do you know its more common name? sand

3. If it now costs $/0 a watt to generate electricity by means of solar cells, how much would you have to spend on equipment to power just the 100 watt light bulbs in your house? # of bulbs x 100 x $10

4. What do we need to do before we can use solar cells as an energy source? further develop technology and bring down cost; provide industry capacity for mass production, and reduce cost

5. How can electricity be stored to use later? in storage batteries

## THE ADVANTAGES AND THE DISADVANTAGES OF SOLAR ENERGY

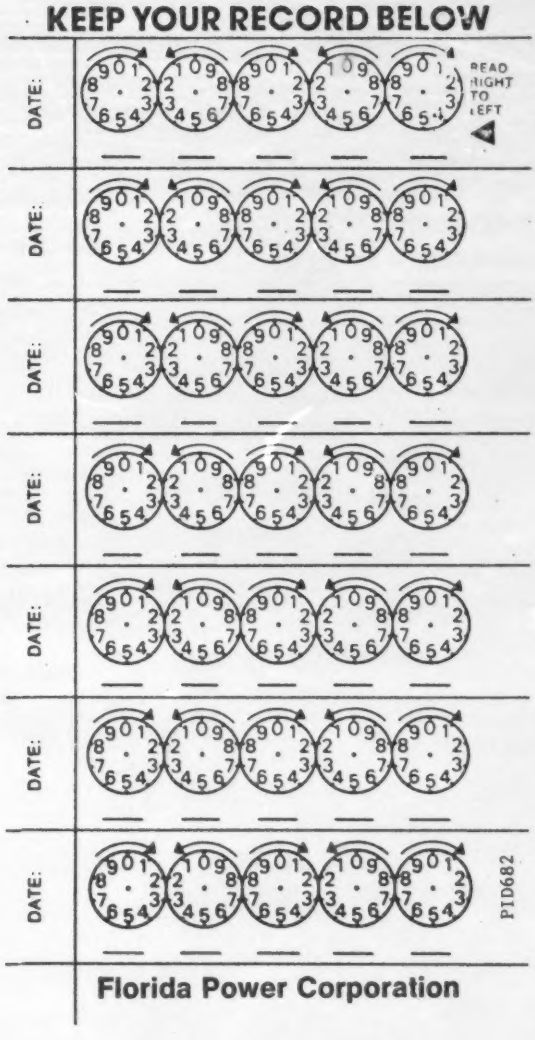
### DISADVANTAGES

1. Expensive to install
2. The sun doesn't always shine
3. Would mean modification of buildings in many cases
4. New laws would be needed concerning construction that might cast shadows

### ADVANTAGES

(See if you can supply the advantages. What is good about solar energy in regard to each of the following?)

1. Supply. The sun's energy is almost inexhaustable
2. Pollution. Solar energy is clean; no mining or burning.
3. Embargoes. No nation can cut off another nations supply of sunlight.
4. Cost. Installations are inexpensive to maintain.




PART SEVEN --

LESSONS WITH
"AUNT ENERGINIA"

To do these lessons, teachers must contact the Florida Power Corporation to get classroom sets of "The Adventures of Aunt Energinia" (1979, Southern California Edison Company).

I. Mark McMarvel's Magic Show

A. This activity combines language arts and math skills with developing an appreciation of energy demands and uses.

B. The students shall:

1. Orally read about Mark
2. Answer questions about Mark
3. Hand in papers to be corrected

C. From The Adventures of Aunt Energinia, p. 23.

II. Kinetic Energy and Potential Energy

A. Orally read pages 48-49 in Principles of Science Book I dealing with these two types of energy.

B. Short discussion on material read.

C. Activity on page 49 "What happens when you shake sand?"

D. Discussion of activity.

III. Tour of Wauchula Power Plant

A. General discussion on how the plant works.

B. Meeting and tour of facility including questions about plant functions.

C. Discussion and short quiz about the tour

IV. How to Read a Meter, by Waldo

A. Hand out copies of How to Read a Meter from Aunt Energinia Teacher's guide, p. 26.

B. Orally read directions for reading a meter.
C. Assign the week-long meter reading chart.
D. Discuss students readings comparing kilowatt hour used per day and why some houses use more or less.

V. Solar Energy

A. Orally read pages 58-61 from Principles of Science Book I about Solar Energy and discuss them.

B. Activity I, Heat from the Sun, p. 60. This activity deals with different colors of glass bottles with ballons over the necks.

C. Activity II, Collecting Solar Energy, p. 60. This activity deals with concentrating solar energy with a magnifying glass and collecting it in a glass bottle.

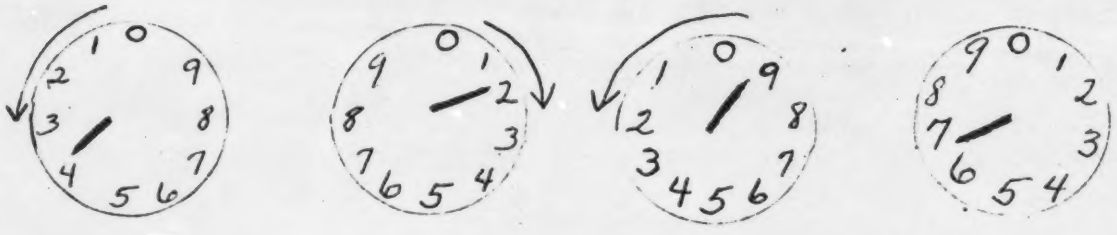
D. Discussion of activities.

How to Read a Meter, by Waldo

Learning how to read your electric or gas meter will help you keep track of how much energy you are saving with your conservation efforts. The drawing below has four dials which look like watch faces. Notice that Dials "A" and "C" turn clockwise, and "B" and "D" go counter-clockwise. It is easiest to read the meter from right to left, starting with Dial "A".

In reading each dial, record the last number passed by the pointer, (for example, write "7" for Dial "A"). When the pointer seems to be directly on a number, look at the dial to its right. If the pointer has not yet passed ")" on the right hand dial, record the lower number on the left hand dial. The complete reading for the meter below would be

4 1 9 6 Kilowatts



Now try reading your electric meter every day for a week and record the results on the chart below. To calculate Kilowatt hours/day, subtract the last reading from the newest reading (subtract yesterday's from today's).

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | | | | | | | |
| METER READING | | | | | | | |
| KILOWATT HOURS/DAY | | | | | | | |